THE BULLETIN
OF THE
AMERICAN CERAMIC SOCIETY

A MONTHLY PUBLICATION DEVOTED
TO THE PROMOTION OF CERAMIC
EDUCATION AND TECHNOLOGY

MAY • 1934

VOLUME 13 NUMBER 5

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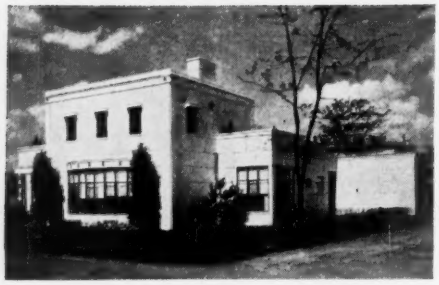
Publication Office: 20th & Northampton Sts., Easton, Pa.
Editorial and Advertising Offices: 2525 N. High St., Columbus, Ohio.
Executive Office: 2525 N. High St., Columbus, Ohio.
Committee on Publications: L. NAVIAS, *Chairman;* L. J. TROSTEL, M. F. BEECHER, R. M. KING, ROSS C. PURDY

Entered as second-class matter at the post office at Easton, Pa., under the Act of March 3, 1879
(Copyright 1934, American Ceramic Society)
Subscription $1.50 a year. Single numbers twenty-five cents
(Foreign and Canadian postage, 50c additional on subscriptions)



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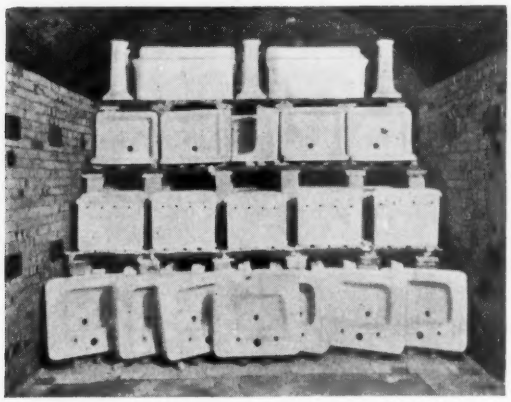

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of Technical, Scientific, and Art Questions

Vol. 13 May, 1934 No. 5

EDITORIALS

SPECIALIZATION IN COLLEGIATE EDUCATION*

By Ross C. Purdy

It seems necessary to repeat statements of my beliefs. I believe (1) in specialization in branches of education such as law, medicine, ceramics, electrical engineering, metallurgy, etc.; (2) that each state in which ceramics is of industrial importance should maintain a ceramic school and research station; (3) that ceramic industries are directly benefited by ceramic schools through information developed and men trained; (4) that the present-day requirement is for ceramic technologists and engineers more thoroughly trained in the elementary sciences and in the use of science methods for measuring the "cause and effect" of desired properties of ceramic ware; (5) that empirical facts regarding compositions should be taught only incidentally to ceramic ware properties; (6) that ceramic lecture and laboratory courses devoted to exposition of facts known and published should be discontinued; (7) that the curricula should not be diluted by "required" or "elective" courses in business, commerce, or law.

In former editorials the fact has been stressed that the aggressive, successful ceramic engineer will direct his investigations to ceramic ware development and promotion; that the ceramic corporation which does not team its technical men as much with the sales as with the production department is not getting maximum returns from its employment of college-trained technical assistants. The ceramic technologist and ceramic engineer must be "product-minded."

Often I have recommended that ceramic schools offer distinct courses in ceramic art, technology, and engineering. When initiating ceramic education at the University of Illinois in 1905, I secured the establishment of two distinct ceramic courses, technology and engineering. The technology course was abandoned shortly after I left Illinois to go to Ohio State University but was reëstablished a few years ago. My advocacy of a course in ceramic art resulted in the establishment at Ohio State University of a ceramic art curriculum in the Department of Fine Arts. Ceramic art instruction should be, and soon will be, more devoted to art in utilitarian ware and less to "artware."

Last fall, when planning a celebration of the fortieth anniversary of collegiate ceramic education in America, many letters were written and many conversations held. The most startling revelations were as follows: (1) The schools have been indifferent to recommendations made at the 1933 Annual Meeting by ceramic industrial leaders. (2) The University of Illinois has given and Ohio State University is considering a generous allotment of ceramic-curricula time to "commerce studies." (3) The time allowed at Ohio State University to mathematics and physics has been reduced. (4) The engineering college deans and faculties have been of the impression that mathematics taught by nonengineers in the Mathematics Department was not of practical value, hence should be curtailed. (5) Quantitative chemistry is taught to ceramic students in some schools by ceramic instructors or by instructors in metallurgy rather

* Editor's Note: This year being the fortieth anniversary of the founding of collegiate ceramic education in the United States, the theme of the 1934 editorials will be ceramic education. Since the points raised and the opinions expressed will be controversial in character these editorials will be signed, thus showing that the views stated have not previously been submitted for approval to the Board of Trustees, the Publications Committee, or the Committee on Education. The pages of *The Bulletin* are open to any one who cares to register his views on ceramic education. Communications received will be published without being censored.

Reference is also made to editorials on this subject appearing in consecutive issues of *The Bulletin* since November, 1933.

than by Chemistry Department instructors. (6) Ceramic instructors are teaching such pseudo-geological courses as "Occurrence and Properties of Clays" rather than allowing the pupils the equivalent time (five credit hours) in fundamental geology of ceramic materials taught by geologists. (7) In some ceramic schools, notably New York State College of Ceramics, even such elementary courses as English are taught by the ceramic faculty rather than by the instructors in the English Department.

Supposed and actual weakness in instructional staffs of collateral departments and the desire to find more teaching hours so as to be able to secure a larger departmental staff and to have the largest possible number of students registered in special departmental courses so as to secure the largest possible share in the operating and maintenance budget have caused weakening of ceramic curricula.

My editorial for April was being set in type when I chanced to peruse the March 31 number of the *Saturday Evening Post* and read Kenneth Roberts' article on collegiate education. I recommend that this article be studiously read by every one who is interested in collegiate education. Roberts emphasizes the same cardinal principles of pedagogy as have been set forth editorially in these pages, *i.e.*, training men to think rather than giving them a lot of empirical facts of value in themselves but of doubtful value as the burden of lecture and laboratory courses.

Roberts defines a trained mind as follows[1]:

> A trained mind is one that has learned through extensive reading of books dealing with several related subjects, as well as through the guidance of competent teachers, to understand why the subjects are related; to criticize intelligently the statements and opinions that it encounters in its reading; to distinguish between that which is false and worthless and that which is genuine and worthy; to think, in short, for itself, and to go on thinking for itself through life; to speak and write clearly and logically on any subject concerning which it has formed an opinion; and to have a sincere appreciation of and respect for intellectual pursuits. . . .
>
> The sole function of a college or a university, these educators insist, is the training of minds; not the technique of trades or businesses. Properly trained minds, they say, can master any trade or business in a few months, or a few weeks, if not in a few days—or even in a few minutes.

[1] *Sat. Eve. Post*, pp. 10–11, March 31, 1934.

Particularly do I commend the criticisms quoted by Roberts from the University of Michigan student publications, from which the following are excerpts.[2]

> Many have matriculated here only because they have been told that education brings economic success. . . . It would have been far better had they been trained before coming to college to prepare themselves for the enjoyment of intellectual curiosity and intelligent living rather than for any such materialistic conception of college life. . . .
>
> The majority of those here are not men and women who have been trained for action. No one has told them that they should think for themselves and then act. They have been told to memorize and then write.
>
> Between the lazy prodigals and the indigent imbeciles, so much dead wood is carried along in the classrooms that the truly able and faithful student is largely cheated of his chance to get ahead. The university is put in the position, not of an institution of higher learning but of a high-class asylum for the pampered and the unfortunate. We would rather see a few students graduating with a lot of education, than a lot with a little.

Especially do I commend thoughtful reading of Roberts' parable "The Tortoise and the Hare" of the two young men who prepared themselves for careers in journalism, the "tortoise" by training his intellect in the fundamentals of philosophy, politics, and economics, and the "hare" by specializing in journalism.

Roberts considered only the Arts College curricula. It is sad to relate that his criticisms are equally applicable to engineering curricula.

The "new deal" in industry and the competition of highly publicized nonceramic products, conceived to meet most satisfactorily specific requirements and promoted by well-trained specialists, require that the ceramic industries shall employ well-trained minds, and it is the opportunity of our ceramic schools to furnish men thus trained. Rather than to take the time and effort to dictate, copy, and learn a lot of formulas, theories, plant practices, all of which are abundantly published and readily available, my plea—repeated for emphasis—is that the bulk of the curricula be devoted to the fundamental sciences which the ceramist must know and that the special ceramic items in the curricula be devoted to the study of ceramic products using science and "practical" facts known.

[2] *Ibid.*, p. 83.

A METALLURGIST LOOKS AT CERAMICS*

By H. W. Gillett

My personal background is that of a metallurgist. No one of us metallurgists can long travel any metallurgical route without meeting some problem in refractories, so we all must have at least a bowing acquaintance with that particular branch of ceramics. In the last few years, at Battelle Memorial Institute, we have been indirectly connected with ceramic problems through our interests in metallurgy and fuels—and fuel utilization, like metallurgy, immediately involves refractories. We have also been very directly connected with research on refractories themselves, as well as with enamels, heat insulation, and various architectural problems into which ceramics enter. Hence, I do not feel out of place in a ceramic gathering, nor do I count myself an outsider.

For our present purpose, however, I wish to take the position of an outsider, of a metallurgist looking at the ceramic industry, to point out a few similarities and differences, and perchance to suggest for your consideration a few questions as to whether or not some modes of attack being used by metallurgists might be applicable to ceramics as well. I do not seek to answer these questions, but only to raise them.

Perhaps the most notable trend of the past decade in metallurgy has been the development of tailor-made alloys to supplement off-the-counter buying of old-line so-called "standard" products.

All industry is finding that it pays to produce what the consumer wants, and still more, what he needs. Instead of saying, "Here's what we make, you can take it or leave it," that is, "You can have any color model T you want as long as it's black," nowadays we give the greatest attention to the customer's preferences. Witness the General Motors' questionnaire and the effort to put into the 1934 cars what the public says it wants in a motor car.

General Electric advertises in regard to its synthetic plastics, "We can change the properties to fit your needs." In a recent bulletin to the members of the National Coal Association, we read, "The consumer is running your business today. More and more he wants automatic heat." The bulletin goes on to say that unless the coal dealer develops automatic heating devices and suitable coals in suitable sizes, competitive fuels, gas and oil, will wipe out much of the market.

The metallurgical industries are learning this lesson. Though the development did not come as rapidly as the technologist, who saw its inevitableness, expected, the stainless steels have now acquired a tonnage status and the tonnage manufacturers have installed plants or departments for its manufacture. No longer do they expect to sell steel that becomes unsightly through rust and has to be replaced promptly for those applications in which looks or life are so important as to make the expensive steel the best investment.

The stainless development is mentioned first because its importance is recognized even by the nontechnical man, but that is only one of the special steels that has been developed on account of customer needs. The automotive industry has demanded a wide variety of steels with very specific combinations of properties—toughness, machineability, weldability, wear-resistance, lack of distortion in heat treatment, and what not—which differ widely. Not only does a gear steel have to meet different requirements from those of a cam-shaft steel, but gears in different makes and models of cars require different properties.

Though standardization of automotive alloy steels has gone far, the "S.A.E." steels are widely used, yet no user or maker of alloy steels stops there; the user asks for, and the maker provides, tailor-made alloy steels especially combined for the purpose. Not only the automotive and similar industries that use wrought steel, but all the heavy machinery trade that uses steel castings, have demanded special, tailor-made products. The percentage of alloy-steel castings has continued to rise through the depression, and now some 20% is alloy, and not plain carbon steel.

Moreover, the trend is toward the use of several alloying elements in selected and balanced amounts and toward the use of as small a total of the expensive alloy elements as will just meet

* Presented at the Annual Meeting, American Ceramic Society, Cincinnati, Ohio, February 14, 1934 (Refractories Division, luncheon talk). Received February 15, 1934.

the case in hand. Each element is added for a definite purpose after careful study of the service to be met and the properties needed, not by a hit-or-miss process. An alloy steel is as carefully engineered and built up from its components as is the automobile in which it is to be used.

Nor is this tailoring process confined to steel. The aluminum people are building special alloys for aircraft and other uses that have optimum properties for the case in hand. The copper people are doing the same.

All these industries cater to what may look like small special uses; they have men in the field studying the users' requirements and men back in the research laboratories trying to develop something special to meet those requirements. They know that whenever something of improved properties or of more uniformly high quality or of equal quality with the old but cheaper is developed for a special use, other uses, not at first contemplated, will crop up to absorb more of the product.

The metallurgical industries realize that manufacturers who can not supply anything but the old "standard" tonnage material can only command that particular market in which they have a freight-rate advantage and tend to become provincial suppliers only. Those who can offer tailor-made products can sell anywhere.

Moreover in the border zones where freight rates on tonnage products are a stand-off between two or more suppliers, the one who is up on his toes in developing specialties to meet customer needs is likely so to impress his customers that they trust him to maintain uniform quality in his tonnage product. The technical men who carry on the special development work are most welcome visitors to the users' plants and the service they render creates much good will.

It seems to me that this sort of thing is rather lacking in the ceramic industries as a whole. If a blast-furnace operator, Mr. Brown, is troubled with disintegration of his linings, he is likely to shift from Smith's regular off-the-counter brick to Jones' off-the-counter brick at a slightly greater freight rate, in the hope that the Jones' brick will fit his conditions better. It would be rather unusual for Smith to make a careful study of his customer's special requirements and institute a research program to develop a brick that will fit the particular conditions Brown is up against. There seems to be more of a "take it or leave it" attitude in the ceramic industry than in the modern metallurgical industry.

I grant that the nature of the uses of ceramic products is such that this is not as obvious an attitude of mind for the producer as in metallurgy, and that the ceramist has greater difficulty in concocting special mixtures than the metallurgist has in making up special alloys. (The ceramist does not seem to have any word that just corresponds to the metallurgist's word "alloys," and that in itself may be food for thought.)

Yet the two industries are not basically so very different. Both are mineral industries. One deals with metals and their alloys, the other with metal oxides and their mixtures. Both are based in the last analysis on physical chemistry and, both requiring high temperatures, have more in common than most other chemical industries do.

The charts that tell most about how to navigate through the technological shoals are in both cases the phase-rule equilibrium diagrams. Research methods of attack are quite similar, the metallurgical microscope has its counterpart in the petrographic microscope and we could follow up many further analogies to bring out the similarity of the modes of attack used by the scientific metallurgist and the scientific ceramist.

There is, however, a distinct difference in the procedure of the two industries in building up their alloys and mixtures. The metallurgist almost invariably carries his product to complete fusion, with consequent opportunity for high-temperature chemical purification by slagging off, while the ceramist merely fires his raw materials till they sinter together. Only the glass-maker, to some extent the enameler, and the makers of a very few special refractories get the complete mixing and uniformity of fusion.

The metallurgist is now beginning to utilize ceramic methods in the bonding of the tungsten-carbide group of materials for cutting tools and in building up metallic objects from powdered metals without fusion. The German term for this, "metal ceramics," is a quite expressive one, and the metallurgist will more and more utilize these methods of the ceramist.

Metals differ from ceramic products in that most of them are ductile and hence readily formable. Not only can they be fused and cast, but they can be rolled, forged, spun, stamped, and generally "bull-dozed" into very nearly the final

form, and then they can be machined, or at least ground, to the close fits called for in modern uses. Moreover, they can generally be united by welding. These properties, lacking in ceramic products, plus strength in tension and impact as contrasted with the weakness of ceramic products in everything but compression, give metals and alloys far wider and different fields of application than are met by ceramic products.

These properties of ready formability allow easy and speedy fabrication of special shapes from stock material. Ceramic products usually have to be made in special molds or dies, slowly dried and slowly fired so that the production of a special shape of a ceramic product is normally a matter of weeks against days or hours for a special shape from a metal. This cramps the style of a user, who, for example, wants to try a special furnace port that can not be made up from stock shapes. Glass can be hot-worked into the desired shape, and cement cast into the desired form. Some progress is being made in development of monolithic refractory linings that can be cast or rammed and then fired in place without excessive shrinkage. Progress is also being made in production of carefully sized brick and shapes which will fit into place so that we no longer have to use nearly as much cement as brick, or need an open-hearth roof fail prematurely because a warped silica brick got in, but in general the size variation of supposedly uniform-sized ceramic products is a long way from the modern mechanic's idea of interchangeable parts.

There would seem to be a possibility of a compromise in properties by which a ceramic material might be made in fairly large blocks, stored, and machined into such special shapes as are needed. Just as a stunt I had our machine shop make up this nut and bolt from one of the ceramic products being developed at Battelle. This compares favorably with many other ceramic products in its strength and refractoriness, yet it can be formed, as this sample was, with ordinary modern machine-shop equipment. Even much more difficultly machinable materials could be formed with modern grinding equipment.

While the sample, as I said, is just a stunt, and does not exactly illustrate the point I have in mind, it may serve to emphasize that the metallurgist wonders why the ceramist is content with the difficult formability of his products.

It is difficult to imagine anything in ceramics exactly analogous to welding of metals, yet there are modern cements that join brick into monoliths without the joint being very much less resistant than the brick. This is surely a step in the right direction. One wonders whether standard brick, of size chosen so they can be grasped in the hand for laying, will not ultimately be replaced by larger shapes, of composition chosen to avoid shrinkage difficulties in firing, which will be put in place by mechanical hands that do not mind the weight. Railroad rails are getting longer all the while; we now have 60-foot rails, though they were first made in 6-foot lengths.

Some of the modern magnesite brick are so vastly better than the old-time product in regard to spalling that the ceramist ought to be hopeful of eliminating the bad properties of a wider range of products while still retaining their good ones. The older example of low-expansion glass that can be used for baking dishes and such purposes should also give hope. It is possible to produce special properties in ceramic products so that the properties are quite different from those normally present in the old-line materials.

The metallurgist is accustomed to utilizing structural combinations of metals as well as alloyed combinations. He coats duralumin with pure aluminum and makes duplex nickel-clad and stainless-clad sheets for better corrosion resistance, and uses case-hardening and nitriding to give hard, wear-resistant surfaces. The ceramist does something of this sort with his many glazed products, and has sometimes attempted it in refractories graded from a highly heat-resistant face to a heat-insulating back in one block, usually with bad luck because of difficulties from thermal expansion. Still it does not seem necessary to give up all hope in this line, though a better solution seems to be to make a truly refractory brick also of heat-insulating properties. Considerable attention is being paid to this, and we have gone along that track ourselves at Battelle.

In the aviation field the aluminum alloys and the heat-treated alloy steels are being developed on a strength-weight basis with intense rivalry between them. The strength-weight point of view enters in masonry construction in architecture, and ceramic products that are light but strong in compression and in transverse strength are much needed. Most of the ceramic possi-

bilities that also combine fairly good heat- and sound-insulating properties will not serve for direct exposure to weather, so composite blocks of ceramic products faced with metal for protection, with the metal in turn protected from rust or tarnish by an enamel coat, seem to be in the picture. Just because a ceramic manufacturer can not sell brick for construction of the upper stories of sky scrapers does not mean that he can not sell some other ceramic product for that purpose. The metallurgist does not despair because he can not make a thing wholly of metal; he is willing to drag in other materials to fit the case so long as he can get some metal into the combination.

Probably the greatest difference between the metallurgist and the ceramist lies in the way they choose their raw materials. The metallurgist first tears down the impure ores by mechanical concentration, then smelts them and purifies them till he has reasonably close to a set of pure chemical elements, and he finally alloys these relatively pure metals in just the proportions that will give him just the properties he needs. Indeed, "relatively" pure is, in the case of many metals, verging on the absolutely pure, even in commercial metals. Zinc used to contain from a half to a couple of per cent of impurities; today 99.99+% Zn forms a large proportion of the tonnage, and will ultimately form much the lion's share. Because high purity zinc is available and cheap, the die-casting industry has assumed large proportions. Die castings from impure zinc swelled and cracked in service—many of you will recall radiator-cap ornaments on your own cars of a few years ago that soon became far from attractive—but they do not do that any more because they are made from high-purity material. Now you find die-cast parts all around the automobile and in a vast variety of other uses.

Gold, silver, copper, aluminum, magnesium, cadmium, lead, tin, tungsten, molybdenum, nickel, sodium, platinum, etc., can all be obtained in large commercial quantities, in extreme purity from, in some cases, as low as 99.95 up to such purity that it takes a spectroscope to establish the presence of any foreign element. Each of these finds uses that it could not enter at a lower range of purity.

Indeed, only a few important metals such as iron, manganese, chromium, and vanadium are too difficult and costly to prepare commercially in tonnage lots in a really pure state, though all are being purified for special purposes. Even these are purified to be definitely below a certain limit in harmful impurities for the purposes intended. Scrap offers the only major problem of impurities, for it is generally too costly to unscramble alloy scrap completely into its elements before re-use. Even here there is much purification of secondary metals and always careful sorting.

As a result of this situation, geographical designations are practically absent from metallurgical terminology. We still have Straits and Banka tin, Chinese antimony, and Lake copper, the first three connoting previous or present degrees of purity or impurity, the latter an intentional retention of a trace of silver which is desired for special purposes. Pig iron varies to some degree with the source of the ore, but when this is turned into steel, we do not differentiate between iron from Lake Superior and from Alabama. Copper from Arizona or Chile, chromium from Greece or Rhodesia, manganese from Russia or Brazil, are merely copper, chromium, and manganese.

Contrast this metallurgical situation with that in ceramics where so many clays are designated by a geographical name to connote their impurities and properties, where magnesite is Austrian, Grecian, Californian, or what not, not magnesite. The aluminum-silicate refractories contain not only Al_2O_3 and SiO_2 but from a tenth to 3 or 4% of several adventitious impurities. The glass-maker, and to a lesser extent the enameler, and the makers of fused alumina and magnesia, those products which are taken to complete fusion, can figure on the chemical percentage basis rather than on the proportions of different "geographical" raw materials and are relatively independent of the sources of raw materials as long as the final product has the correct analysis.

The ceramist's plastic clays are chosen not only for their chemical composition but also for their physical properties, and they must have "weathered" to just the right degree. One wonders whether it is always really necessary to pick and choose from what nature provides instead of making what one wants. For example, electrically sintered magnesite can be water-ground and hydrated to form a plastic clay-like bond. Some properties of clays depend on their hydrogen-ion concentration and, by base exchange or other chemical treatment, a certain amount of control can be exercised.

The impracticability of unscrambling the oxides in the ceramic raw materials certainly cramps the style of the ceramic engineer, and no one would suggest that it need be done in the manufacture of red brick or sewer tile. Indeed, most of the lines of attack I am suggesting are primarily applicable to cases where some special physical property is needed, as in structural building materials and in special refractories. As far as I know, your methods of making dinner plates and toilet bowls may be quite satisfactory. As a metallurgist I know that refractories as a class ought to be capable of a lot of improvement. When special properties are needed, as in electrical or spark-plug porcelain, purification of ceramic raw materials is already the order of the day. But if the metallurgist had to depend on the ores as they come without mechanical or chemical purification or refining beyond the degree used in ceramics, he could provide Monel metal and a crude grade of cast iron made direct from the blast furnace and not much else, instead of the ever-growing list of useful alloys. Indeed for some purposes it might not be as crazy as it sounds to approach some ceramic problems by first making a pure metal, from that a pure oxide, and then "alloy" the pure oxides.

Magnesium is actually used as a source of MgO for electrical and heat insulation in some electrical heating devices. The research metallurgist seeking to maintain extreme purity in a metal melt very often has to make up his own refractories in some such manner because the best commercial refractories have impurities that contaminate his melts. At least, the elimination of a goodly proportion of the harmful impurities from the raw materials of the ceramic art by the methods of concentration used in beneficiation of ores and the washing of coal seems so logical and inevitable where quality products are desired that the metallurgist can not understand why so little of that sort of thing is done by the ceramist.

Metallurgy had advanced step by step with the increase in purity of the metals, with the more precise research information made possible by their availability, and with the commercialization of high purity raw materials. In ceramics, silica is about the only raw material of anything like a purity that the metallurgist would consider reasonable in this day and age. For an approach to purity of special raw materials, the ceramist still scours the world for a little pocket here and there where nature has laid down a fairly pure material.

For the equilibrium diagrams that are the basis of his science he does use pure materials—you do not find the Geophysical Laboratory doing fundamental work on an oxide system with a lot of impurities in it. But the industry does not seem to be attempting to even approximate pure materials in its commercial products. The metallurgist is constantly coming closer to research purity in commercial products. I could name several cases where it makes a vital difference whether the percentage of an added element or a residual impurity in an alloy system is 0.04 or 0.06%.

While anything approaching that is quite a lot to ask in a ceramic product, the elimination of a large proportion of harmful impurities by jigging, washing, tabling, etc., would often be so cheap and simple that the metallurgist can not grasp why so little attention is paid to it.

During the last decade the metallurgist has employed a new servant, precipitation-hardening. This phenomenon is utilized to produce the strong duralumin group of aluminum alloys, the nickel silicide and the beryllium alloys with copper, iron-copper alloys, and so on through a long list. Indeed, it is the rule rather than the exception to find precipitation-hardening possibilities in an alloy system when it is examined from that point of view, even though the older equilibrium diagrams gave no hint of it.

A glance through the ceramic diagrams collected in the October issue of the *Journal of the American Ceramic Society* shows solid solubility relations leading to precipitation-hardening possibilities in the calcium silicate side of the calcium orthosilicate-fayalite diagram, though this is complicated by another inversion in the matrix at lower temperature.

The zirconia-thoria diagram is analogous to the gold-copper diagram, and those alloys are the basis of hardenable alloys used in dentistry. Whether the precipitation-hardening possibilities in the ceramic systems might lead to useful products, I do not attempt to say. My point is that the metallurgist is alert to consider such possibilities in the systems with which he deals while the ceramist does not appear to be thinking about them. It scarcely seems possible that a study of oxide systems should not reveal more

than the two cases shown by the present diagrams.

I realize that ceramists have done a great deal along some of the lines that seem logical to a metallurgist, and that profitable markets have not sprung up for some of the products that were improvements over the off-the-counter standard ones, but for which a high price had to be charged. There have been plenty of metallurgical products that did not immediately find wide distribution either, but when the producers kept on improving the quality and lowering the cost of production by continued research, by and by the point was reached where somebody wanted those special properties enough to pay the price, the material went into production and before long began to make a profit.

I realize that ceramic advances of the type I am suggesting can be cited in individual cases but, in their adoption by the industry broadly and as a whole, ceramics appears to me only to have advanced to about the state the metallurgical industry was in, in this regard, twenty or thirty years ago. I am inclined to think that the pioneers who are working along these lines now are on the right track, that those who have previously tried that sort of thing and could not make it pay were ahead of their time, and that the time is approaching when the ceramic industry, too, will find that it pays to make tailor-made products, just as it has paid and is paying in the metallurgical industry.

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THE SACRED POLARISCOPE*

By F. W. Preston

Once upon a time there was a glass industry without polariscopes, and it made bottles among other things. And a wise man arose and said, "Behold, this is most unscientific, for ye anneal bottles and wot not how well they be annealed. Of a sooth, ye should use a polariscope."

Then produced he one of the infernal things and bade them look at the pretty colors, and they were both astonished and charmed also. And they said, "It is a blessed word: give us now this polariscope," for it was pleasant to behold; and they paid a great price for it.

Now the wise man knew nothing about bottles, and they that made bottles knew nothing about polariscopes. And because it was very mysterious, they went in great dread of the thing. And though eftsoons they wearied of it, yet walked they ever in fear of it, for they said, "Lest someone put our bottles in a polariscope and find them out."

And this is just what did come to pass, for the wise man hied him to the vendors of milk and to them that sued in the lawcourts and showed them his polariscope, and they laughed with glee exceedingly and rubbed their hands together, crying, "Now will we 'crack down' on the makers of bottles and fatten at their expense."

So the bottle makers were fain to make bottles that looked good in the polariscope, though they found such bottles inferior by every other test, and they were sore perplexed and said, "Alack, what shall we do? For the judge that judgeth us in court knoweth nothing of these things and he hath called the polariscope 'infallible.'[1] And if we make things right by the polariscope, then is the bottle less strong than if it be indifferent by the polariscope, and he will crack down on us for the insufficiency of our thermal shock and hydrostatic tests. Whereas if we make these other tests sufficient, he will say, 'Ha! Ha! By the Hair of my chinnie-chin-chin, and by the Polariscope, ye do sin.'"

So the bottle makers sat around in terror of the polariscope, like so many frogs fascinated by a serpent, and only a few had the courage to say, "Behold, that wise man was a damn fool; and lo, aren't we all?"

* Presented at the Annual Meeting, American Ceramic Society, Cincinnati, Ohio, February, 1934 (Glass Division). Received February 15, 1934.

[1] Smith *vs.* Peerless Glass Co.

PAPERS AND DISCUSSIONS

AUTOMATIC GLAZING IN THE CERAMIC INDUSTRY*

By H. V. Schweitzer

ABSTRACT

Circular and straight-line conveyer spraying machines and the suitability of each to different uses are described.

I. Introduction

This paper is concerned chiefly with automatic glazing in plants that manufacture dinnerware, hotelware, wall tile, structural hollow tile, enameled brick, porcelain insulators, spark plugs, glassware, and vitreous enamel products, in fact, almost any type of product that is coated with glazes, engobes, underglaze and vitrifiable colors, or vitreous enamel. Spray guns and equipment can be used to coat the smallest or largest objects with greatly reduced labor costs and increased production as well as with much higher quality work. Effects and finishes may also be produced which are impossible by other methods. Automatic spraying devices can therefore be used extensively in the ceramic industry.

Two general types of automatic spraying machines have been found suitable. Minor variations may be necessary in their design, depending on plant layouts, the size and shape of the products, and the nature of the coating to be applied. These two types of machines are the circular machine and the straight-line conveyer machine.

II. Circular Automatic Spray Machine

The circular type is most suitable for objects that have to be spun while being sprayed. This machine consists of a turntable approximately six feet in diameter, driven by a variable speed drive, with either air or electric motor. Spindles are built in the circumference of the turntable at predetermined spacings. These spindles are equipped with gears which mesh with an adjustable gear rack mounted on the table at the spray station so that the spindles rotate only while the article they are supporting is being sprayed. The gear method of spinning the ware is preferable to friction spinning because, with the lack of positive spinning in friction, the spindles will occasionally stick, resulting in rejects. The speed of the spindle can be made variable if desired. Where a great variety of shapes or coatings is to be sprayed on the same machine this feature is advisable. It is obvious that the rate of spinning should depend on the nature of the coating material, the surface to be coated, and the shape of the object.

The pinion gear on the spindle meshes with the gear rack causing the object to spin. The adjustable arm which causes the gun to move with the ware comes in contact with the spindle. The cam roller on the spindle contacts the lever of the on-and-off control and the guns begin to spray. After the proper coating is applied, the cam lever is released, the guns shut off, and the oscillating device pulls the guns back to the starting position. The pinion gear then comes to the end of the gear rack and the ware stops spinning. With such a spray station, it is possible to coat approximately sixty pieces per minute on a basis of one piece to a spindle. As light or as heavy a coat as is desired may be applied. This depth of coat is controlled by the pressure on the fluid tank and by the speed of the table. It can also be controlled by a mechanical adjustment on the gun. Any one or more of the guns may be turned off without interrupting the operation of the others, or all of them may be turned off at once by the main valve.

For coating ware that does not have to spin, another turntable type of machine, slightly different from that just described, often works to better advantage than the straight-line machine. This depends on plant layouts and production lines. Instead of spindles, rust-proof wires around the edge of the table are used and the ware rests on these wires. The ware is then placed as close together as possible without touching. This precludes the necessity of having the guns open and close between the pieces of ware; therefore, a much simpler gun than the one used on the

* Presented at the Annual Meeting, American Ceramic Society, Pittsburgh, Pa., February, 1933 (White Wares Division). Received December 21, 1932.

machine previously described can and should be used. This also precludes the necessity of on-and-off controls and the device for moving the guns with the ware. Aside from these changes, the machine has the same features as the one previously described.

III. Straight-Line Conveyer Spray Machine

The straight-line conveyer machine is of various lengths, depending on the application. It is driven by a variable speed drive, either air or electric motor. For some products a mesh-wire belt is best for carrying the ware on the conveyer; for others, two or more cables answer the purpose. The cables or belt are supported with the necessary gravity rollers made of either metal or wood.

The spray station consists of the spray guns, tanks, hose, regulators, separators, reclaiming chamber, and exhaust equipment. Where multicolored guns are used, it is not possible to reclaim the material, but if separate independent guns are used the excessive spray of each color may be reclaimed.

Any of these types of machines may be equipped with one or more spray stations as required, depending on the importance of reclaiming the material, the number of colors being used at a time, the shape of the object, the viscosity of the fluid, and the porosity of the body.

Where forced drying is advisable, equipment for this purpose can be installed using either steam, gas, oil, electricity, or waste heat.

The spray guns are adjustable and controllable as to width of spray, speed, and degree of atomization. The size of the stipple or mottle is controlled by proper setting of the fluid pressure and air pressure.

Exhaust systems are simple and are arranged to save the glaze. The circular machines exhaust toward the center into the removable collector baffles. There may be separate sections for each color. The line conveyer type exhausts near the level of the belt, thereby assisting in producing uniformity of coat and in minimizing material loss.

Very little time is required for cleaning the machines when changing colors, the entire operation taking only about fifteen or twenty minutes.

Where conveyer systems are installed for other purposes, it is practical to build the automatic spraying equipment into these conveyers, thereby saving floor space and reducing the installation cost.

IV. Cost Reduction in Glazing Tableware

In tableware plants, several applications have been executed advantageously by the automatic spray method over other methods. Body glazing or the application of solid coats of underglaze color on flat ware and semihollow ware can be executed at a saving of 25 to 40% over the hand-dip method. With the type of machine used the ware does not spin while being sprayed. For spraying hollow ware, it is necessary that the ware spin while being sprayed to obtain uniformity.

The machine has two spray stations: one for spraying the bottom of the ware and the other for spraying the face. Three operators are required for placing the ware on the machine, for turning it over after the bottom has been sprayed, and for removing the ware after the face has been sprayed.

V. Glaze Saved by Spray Method

Less glaze is used by the spray method than by the dip method, since all of the glaze that does not hit the ware is returned to the feed supply. It is also possible to apply a lighter coat on the back of the ware than on the face, thereby effecting another saving in glaze. No marks remain on the ware by this method of glazing, whereas finger marks and glaze curtains are almost always found on hand-dipped ware.

Each piece of sprayed ware gets the same weight of glaze since the guns spray a definite predetermined and controllable amount of glaze per minute on a predetermined and controllable number of pieces of ware per minute. By the dip method, two tubs containing glazes of different viscosity are usually necessary and the dipper immerses high porosity ware in the thin glaze and low porosity ware in the thick glaze. This means that by the spray method the human element is removed in obtaining the proper weight of glaze applied.

VI. Decoration by Spraying

For banding, tinting, and stenciling tableware, the type of machine which spins the ware as it is

being sprayed is used. Several types of shields and stencils may also be used. In addition to these, it is imperative that there be proper regulation and control of pressures, proper distance and angle between the guns and the ware, and proper consistency of the fluid.

Two operators are usually required on these machines, one placing the ware on the machine and adjusting the shield, the other removing the ware. The capacity of the machine is limited to the speed of the operators. One girl should be able to handle 30 to 40 seven-inch plates per minute, which would result in an hourly production of 150 to 200 dozen.

Automatic spraying is suitable for spraying engobes on tableware after which the ware is given a clear coat of body glaze. This method is also advantageous for body glazing single-fired ware. By the dip method of glazing single-fired tableware, it is usually necessary to use a heavier body than is used for double-fire, but by the spray method, the same body thickness can be used for single-fire as is used for double-fire.

VII. Better Finishes on Glassware

In glassware plants this method of application is highly advantageous for coating flat glass or shapes with vitrifiable colors or cold lacquer. With vitrifiable colors it is advisable to get the proper thickness of coat by building it up with several light coats rather than two or three heavy coats, since the vehicle must evaporate due to the fact that the body is vitreous. With the proper controls, such conditions as orange peel and sagging in cold lacquers, and pitting, orange peel, blisterings, and sagging in vitrifiable colors can readily be eliminated.

With this method it is possible to coat shapes such as bottles at the rate of 800 to 1200 square inches per minute, depending on the contour of the bottle and the speed of the operators. This is usually accomplished with two operators. The ware is taken directly from the machine to the leer by the conveyer.

VIII. Advantages of Spraying in Brick and Tile Plants

For single-fire or double-fire brick, wall tile, and structural hollow tile, a straight-line conveyer type of machine is most suitable. For brick and structural hollow tile, the machine must be much longer than for wall tile, because the guns must be much farther apart in order to effect proper drying between coats and subsequent uniformity and smoothness. For wall tile, two to four guns, spaced from 15 to 24 inches apart, are necessary; while for enameled brick and hollow tile four or five guns, spaced approximately 4 to 5 feet apart, usually give best results. These machines spray either solid coats or mottled, speckled, multitone, and multicolored coats at the same rate of speed. On the brick or hollow-tile machine a mesh-wire conveyer belt is found to have advantages over a rubber belt, and on the wall-tile machine two conveyer cables are simplest for carrying the tile. Due to the adjustability of the guns, shapes in wall tile can be sprayed at the same rate as flat tile, and the ends of brick or hollow tile can be sprayed as fast as the face only. Brick $2^1/_4$ by 8 by 4 inches are being enameled by this method at the rate of 30,000 to 35,000 per eight hours. Four operators are required to handle this production on the machine. When this production is sprayed by hand guns instead of being sprayed automatically, fourteen men are required.

Hollow tile 4 by 5 by 12 inches are being sprayed automatically at the rate of 25,000 or more per 8-hour day. Eight operators are involved in the operation at this production, while it is estimated that approximately forty men would be required if the work were done by hand. Wall tile $4^1/_4$ by $4^1/_4$ inches can be glazed at the rate of approximately 1000 square feet per hour. The number of operators required in addition to the supervisor varies from three to five, depending on the speed with which they can remove the tile from the machine to the saggers.

Flat tile can be fed advantageously by an automatic feeding device, while shapes usually must be fed by hand. Brick and hollow tile are also usually fed by hand, although an automatic device can be easily designed for this work. It has been found advantageous where possible to heat the ware approximately to 90°F before it is sprayed, as this results in faster drying of the glaze and more uniform rate of absorption. This is especially true if the body has absorbed much moisture from the air.

IX. Spray Method for Enamel Products, Insulators, and Spark Plugs

This method of spraying also is advisable for many vitreous enamel applications, especially flat or semihollow products. A uniform coat

can be obtained at a greater daily production and with less waste of enamel than by the hand-spray method.

It has also been found that such applications as glazing porcelain insulators for spark plugs and many other such products can be executed most economically and with a higher quality finish by the automatic spray method. Spark-plug insulators are also readily stenciled by this method while in the operation of glazing.

The glazing of larger porcelain insulators can be successfully done by spraying and many other types of insulators such as suspension and pin types can be sprayed on the same machine simply by the change of spindle adapters and the direction and number of sprays. Here again the advantage of even coat prevents the usual beads of glaze, curtains, etc., obtained by the hand-dipping method. The application of sand-band adhesive also presents a possibility for porcelain insulators.

The inside of porcelain insulator heads, slender tubes, and sewer pipe can be glazed evenly by means of a 360° spray which also can be arranged to do its work automatically, spraying a 360° circle of glaze as it advances and is withdrawn from the inside of the insulator head or tube.

X. Conclusions

It is apparent that the automatic spray method has the following advantages: (1) it minimizes losses and "second" ware, (2) it reduces labor cost of glazing operation, (3) it reduces floor space required for operation, (4) it reduces handling, and (5) it enables the combining of the glazing and stenciling operations.

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REMOVAL OF "NONMAGNETIC" IMPURITIES FROM CERAMIC MATERIALS*

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ABSTRACT

Methods of classifying materials are listed and compared. The results obtained on the Johnson induction magnetic separator are given. The process of separating mica, feldspar, cyanite and silica, titanium and ilmenite, ash and combustible in anthracite coal, bauxite, and clay is described. The factors essential to and limiting induction magnetic separation are given.

I. Introduction

In recent years, considerable interest has developed in the fractionation of materials by means of new refinements in the art of magnetic separation. Materials having magnetic susceptibilities of an order so low as to be heretofore unaffected have yielded to these new refinements until it is now certain that a host of apparently nonmagnetic materials can be separated by the proper application of high magnetic flux. The history of this development and its possible uses in the ceramic field are presented.

* Presented at the Annual Meeting, American Ceramic Society, Pittsburgh, Pa., February, 1933 (Materials and Equipment Division). Received February 27, 1933.

There are five general types of separation or selection, all of which lead toward the same goal, namely, removing impurities or gangue from a given product and obtaining what is called a "concentrate."

(1) The most common example of separation is by differences in specific gravity between the desired concentrate and the unwanted gangue on tables, jigs, and classifiers, generally conducted in the wet way, although there are many examples of dry separations by differences in density.

(2) Flotation takes advantage of differences in specific gravity, but the surface tension of the flotation medium plays a part. Flotation methods are used in the ceramic field and a close study of flotation is being made by many investigators.

(3) Electrostatic separation is definitely related to the ceramic field, but it is somewhat limited by cost and by the uncertainty of results due to changes in conditions which are difficult to control.

(4) A miscellaneous group of separation methods depends on the properties of materials as follows: (*a*) visual differences (color, size, etc.), (*b*) difference in hardness, and (*c*) difference in elasticity.

Hand picking and cobbing is an example of a separation depending on visual properties, and feldspar is sometimes separated by this method.[1]

(5) The method of magnetic separation depends on differences in the magnetic susceptibilities exhibited by the different materials.

II. Magnetic Separation

Magnetic separation has found an increasing application in the ceramic field. Materials which heretofore have been considered to be nonmagnetic are found to respond to the forces exerted by the present-day magnetic equipment.

(1) History Although the principles of magnetic separation are very old, the fact that all materials are susceptible to magnetic influence to some degree has been appreciated during the last one hundred years.

In 1878, Thomas A. Edison outlined a classification of various substances, designating them as ferro-magnetic, feebly magnetic, and nonmagnetic. The ferro-magnetic group included iron and certain iron ores. In the feebly-magnetic group were pyrolusite ore (manganese dioxide), nickel, etc., which respond only to the influence of a powerful magnet. Biotite and muscovite mica were grouped as materials which are nonmagnetic.

The development of magnetic separators capable of separating feebly magnetic from nonmagnetic materials had its beginning in the latter part of the 19th Century. The major developments, however, have been concentrated in the period from 1928 until the present day.

(2) Wetherill Separator Notable contributions of the earlier investigators were those of C. Q. Payne and L. E. Rowand who developed the Rowand-Wetherill separator, as well as other types of separators. Other inventors and investigators also made contributions in this field.

The Wetherill separator depends on a horizontal cross-belt operating at right angles to a main conveyer belt. Two or more cross-belts are used, these being placed directly under the magnets which lift the magnetic particles from the main horizontal conveyer belt, traveling immediately under the cross-belts. As material in granular form is carried along the main conveyer belt, it must pass under the two cross-belts. If magnetic particles are sufficiently attracted by the magnets located above the cross-belts, they will be then attracted to the cross-belts by clinging to them, carried beyond the end of the magnets over the cross-belts, and thence dropped off.

The forces tending to lift the particles from the main conveyer belt depend upon the magnetic susceptibility of the particles and the flux of the magnetic field at the point of separation. Magnetic flux may be expressed in maxwells per square inch. The force of gravity tends to hold the particles on the conveyer belt. Whether or not a separation can be effected depends upon the result of the two forces. It is obvious, therefore, that the magnetic lifting force must exceed the gravitational constant of 980 dynes per gram and that the specific gravity of the particles being treated is a factor influencing magnetic separation. If the magnetic particles are sufficiently attracted by the magnets located above the cross-belts, they will be attracted and will cling to these belts until they are conveyed by them out of the dense magnetic field to a less magnetic field where they will drop off into a container for the more magnetic materials.

Considering the type of separator just described, it is apparent that the magnetic force employed operates vertically and in opposition to the force of gravity.

(3) Johnson Induction Separator In 1926, Fred R. Johnson devised a new type of induction magnetic separator in the research laboratories of The Exolon Company. His apparatus utilized the principle of a very high magnetic field intensity, combined with deflection of a falling grain stream by means of a horizontal magnetic force. He found that it is possible to apply a magnetic field in such a way that magnetic force exerted on the particles being separated will be in a horizontal plane or at right angles to the force of gravity and, in like manner, that the force may be applied at any angle between zero and 90°, with relation to the direction of the force of gravity. This type of separator found immediate and ex-

[1] Of interest, but far removed from the ceramic field, is the use of this method in the cranberry industry where the separation depends upon the elasticity or resiliency of the berries.

tensive application in the processes of purifying abrasive and refractory materials.

(4) Magnetic Separation of Mica and Feldspar The separation of muscovite mica from feldspar is an illustration of the type of separation being effected by this apparatus. Muscovite mica and feldspar are light-colored materials, and a casual visual inspection of the mixed materials would not suggest the possibility of magnetic separation, nor would they seem to be magnetic. There is, however, sufficient difference in their magnetic susceptibility so that they may be practically and efficiently separated.

This process is being used for the commercial separation of large tonnages of feldspar by a producer in North Carolina who, by diligent research during the two-year period in which the Johnson separator has been operating in this plant, has been able to increase materially the yield of his resultant concentrated feldspar product.

At first the recovery or yield from the magnetic separator was not over 85% of the head feed. Last year the yield of acceptable material was increased approximately to 95% with a reduction in iron content of from 0.12 to 0.15% to a maximum of 0.05% Fe_2O_3.

(5) Magnetic Separation of Cyanite and Silica In the cyanite industry this type of separator is used to produce a cyanite and silica concentrate of extremely low iron content. The iron-free cyanite and silica mixture is further processed electrostatically. The electrostatic separator divides the cyanite and silica, and the final product is a pure cyanite.

(6) Magnetic Separation of Titanium and Ilmenite Titanium is being prepared by this process of magnetic separation. It is extracted from ilmenite which is separated from the ore magnetically with the further recovery of other useful by-products. It is of particular interest that zircon, a material of growing usefulness in ceramics, is one of the by-products resulting from this treatment of ilmenite ore.

(7) Magnetic Separation of Ash and Anthracite Coal The reduction of ash in anthracite coal has been studied with results that are of considerable interest. The ash content of anthracite culm banks has been reduced to 11 to 12%, making the fuel suitable for briquets and other purposes.

(8) Magnetic Purification of Bauxite Bauxite can be purified by means of this type of separation. The purification of bauxite is of decided interest and importance, and since a great deal of the low silica bauxite used in this country is a product of South America, it gives rise to a great opportunity for domestic producers.

(9) General Development of Separation Processes Comparing the present development with other types of separation used as early as 1900, there would seem to be a decided similarity. There are so many differences, however, that the results achieved would seem to prove that the machines of the earlier type had not been carried far enough into the field of research.

III. Essential Factors in Separation

(1) Product Purity of product is, of course, the essential demand of successful separation. There must be, however, a definite relation between purity of product, percentage of recovery (yield), and continuity of operation. Capacity is likewise an important factor from the commercial viewpoint. Comparable purity may momentarily be achieved through the use of such elementary apparatus as a powerful wall or hand magnet, but ceramic engineers are interested in the economical and continuous selection and separation of materials whose comparative magnetic susceptibilities are relatively slight.

Material to be separated must be mechanically rather than chemically combined. Mechanical combinations must be made of component parts which will separate or release into comparatively pure particles at a size which might be set at greater than 100-mesh. Treatment of particles smaller than 100-mesh on this type of separator is in general more difficult as is the treatment of extreme fines on other types of separators. The ratio between the magnetic force employed and the force of gravity remains the same but, in the case of extremely fine particles, friction of the containing fluid (air or water) on the fine particles may overcome the magnetic force employed and hence may influence the separation. The smaller the particle the greater is its surface in comparison with its mass and since surface friction occurs the

resultant action of that particle may not be that which the magnetic force directs, but may be haphazard due to vagrant air currents. These air currents are present because of the moving rotor and moving grain stream. In one instance, particles of −325-mesh are being separated, but this is an exception, the material being silicon carbide, which has sharp grains with smooth surface.

The material must be dried so that it is free-flowing in order to achieve the best magnetic separation. There is a difference between drying the head feed (which is necessary for magnetic separation) and drying the concentrates (which is necessary in other methods of separation on a tonnage basis). Here, as in all other separation methods, a better result is obtained by screening. It is easy to see that since mass equals volume times density, differences in the size of material fed to a separator of any type, magnetic or otherwise, will be productive of a better separation if the material is closely sized.

(2) Costs The costs of magnetic separation have been so materially lowered that the electrical energy to produce the necessary magnetic flux is just about comparable with the electrical energy used on the breakfast table in preparing toast.

The capital operating costs vary between 7 and 50 cents per ton. Actual installation charges vary directly as the strength of the magnetic flux necessary to produce the magnetic field strengths, but do not increase in direct ratio with the increase of the field strength.

The machine is automatic and does not require constant supervision any more than a belt conveyer, and the claims that experts must be retained to run this type of separator are thoroughly unfounded. Instances may be cited of separators being operated by coolie and peon labor of foreign lands. It is believed that this type of separation has a place in many flow sheets and that while the limiting factors, which are conceded, may prevent its treating a head feed of very low dollar content value, nevertheless it can accomplish results which literature on the subject has described as impossible by other methods.

For example, William M. Thornton, in his book on titanium, makes the following statement (on page 35) concerning Virginia nelsonite:

"Nelsonite has not yet been commercially utilized for several reasons. . . . . It should be noted, however, that a small amount of apatite remaining in the concentrated titanium minerals would not vitiate them for the manufacture of pigment to the same extent as for use in iron and steel metallurgy; hence the future utilization of the nelsonite ores is more promising now than formerly as the pigment industry has become the more important of the two."

Separation has been attempted by tables and it has been entirely possible to get a good ilmenite, but a valuable material, apatite, was left behind mixed with biotite mica. Flotation was tried and one of the well-known flotation companies admitted that their process was not applicable to this ore. Magnetic separation is now working commercially and satisfactorily on a tonnage basis.

There is a peculiar phenomenon of interest to the ceramic field in discussing the limitations of magnetic separation. There are certain materials which look alike, analyze alike, and apparently are alike, but which may have a vastly different magnetic susceptibility. Accordingly, separations of materials from two mines may not be made satisfactorily although the ore in both mines is apparently similar.

Attention has been drawn to the recovery of tailings which must necessarily have been mined. In many instances they represent costless material as they have been written off in the process which originally produced them. They should be studied with the idea of extracting further value by means of the new magnetic development.

IV. Conclusion

In conclusion it is well to emphasize the fact that this is merely one method of separation. It may, however, fit into many flow sheets in the ceramic industry because it can be used to remove deleterious iron in faintly contaminated grains. Heretofore the magnetic susceptibility of these grains has not been such as to respond to the earlier types of magnetic separators.

Separations Engineering Corporation
110 East Forty-Second Street
New York, N. Y.

ACTIVITIES OF THE SOCIETY

Officers of the Industrial Divisions

L. E. Barringer, Charles Harder	Art	R. C. Meeker, H. B. DuBois	Materials and Equipment	J. L. Carruthers, D. A. Moulton	Structural Clay Products
W. N. Harrison, B. J. Sweo	Enamel	H. E. White, R. E. Birch	Refractories	R. F. Grady, Jr., H. E. Davis	Terra Cotta
James Bailey, F. C. Flint	Glass			Edward Schramm, T. A. Klinefelter	White Wares

HONORARY MEMBERSHIP CERTIFICATE PRESENTED TO PROFESSOR LE CHATELIER

On April 16, 1934, a certificate of Honorary Membership in the American Ceramic Society was presented to Professor Henri Le Chatelier by Alexander Silverman of the University of Pittsburgh. Dr. Silverman visited Dr. Le Chatelier in Paris on his return from Spain where he attended a meeting of the International Union of Chemistry and the Ninth International Congress of Pure and Applied Chemistry.

Honorary Membership Certificates in the American Ceramic Society were awarded this year to Professor Le Chatelier and Dr. W. E. S. Turner of England.

Henri Louis Le Chatelier was born in Paris in 1850. He was a senior student at the Polytechnic Institute which he entered in 1869, later going to the College of Mines where he became engineer in 1875 and chief engineer in 1889. He devoted himself solely to the study and teaching of chemistry, having been appointed professor of inorganic chemistry in 1877. In 1882 he also became a lecturer in the Polytechnic Institute and was appointed to the professorship of inorganic chemistry in the College of Mines. In 1898 he became professor of inorganic chemistry in the College of France.

His numerous researches include studies in chemical equilibrium, the combustion of gaseous mixtures, metals, alloys, the formulation of laws of chemical mechanics, the completion of certain laws applying to Willard Gibbs' phase rule, and the explanation of certain fundamental principles of energy. His researches also include glass, cement, and other ceramic investigations.

In addition to many scientific articles, he is the author of Silica and the Silicates, Experimental Researches on the Constitution of Hydraulic Mortars, Safety Lamps, Fire-Damp, and High-Temperature Measurements (with A. Boudouard). Some of these have had numerous translations from the French into other languages.

He is an honorary member of the Polish Academy of Sciences and Letters, a Fellow of the Royal Society of London, and an honorary member of the following: The Institute of France, the National Academy of Rome, the Academy of Sciences of Vienna, Academy of Natural and Physical Sciences of Spain, the Royal Academy of Sciences of Sweden, and the French Academy of Sciences, to which he was elected in 1907, replacing the famous French electrochemist, Henri Moissan. Professor Le Chatelier is now eighty-four years of age.

On April 27, 1934, Dr. Silverman wrote as follows describing the presentation:

I reached Professor Le Chatelier's residence at 73–75 rue Notre Dame des Champs toward sundown. You enter a huge old gate between the two buildings, No. 73 and No. 75, on the street of "Our Lady of the Fields." Going back almost half a city block you enter an old garden with trees, some of which must be centuries old. Beyond this garden court is the little old house in which Professor Le Chatelier lives.

He is a tall, slender gentleman, perhaps slightly stooped, and quite deaf. I was ushered into the parlor which fully harmonizes with the old surroundings in its furnishings, and there I presented Professor Le Chatelier with the document.

The old gentleman was very happy and we conversed for quite a while on the progress that has been made in recent years in the ceramics and glass fields. Later he and Mme. Le Chatelier graciously came out to the garden and permitted me to take some motion pictures, which I hope to show at one of the future Meetings, together with my pictures of Spain.

Professor Le Chatelier is now Emeritus Directing Engineer of Mines of France and still serves in a consulting capacity to the younger men who are in active service.

During the preceding week the University of Madrid conferred an honorary Sc.D. on Professor Le Chatelier in connection with the meeting of the IX International Congress of Pure and Applied Chemistry.

GREETINGS FROM WILLIAM ERNEST STEPHEN TURNER

One of Our New Honorary Members

From Sheffield, England, on February 16, Professor Turner wrote as follows: "I like the new format of the *Journal of the American Ceramic Society*. It provides a nice page width which is not too big and I have no doubt it will help to reduce printing costs. We (the Society of Glass Technology) may be driven to take the same step ourselves, for in these days the opportunities for expansion in publication are substantially greater than the rate of increase of income.

"The programme book giving an account in detail of the arrangements for the Annual Meeting duly came to hand and received a welcome from me. Also, I did not fail to read it through and wish that I could be present to take part in the programme. It must be a source of satisfaction to you and your colleagues to note the definite increase both in the standard of papers and the keenness and seriousness with which the Divisions are tackling their work. Of course, I can realise this better in the case of the Glass Division than in any other, but I have no doubt that what is happening in the Glass Division is also being experienced in different degrees in other Divisions.

"I have not yet had the privilege of being present at an Annual Meeting of the American Ceramic Society. I was present in 1919 in Chicago when a meeting was held in September and have had the privilege of attending one or two special meetings of the Glass Division in Pittsburgh and elsewhere. It would be a real treat to be able to be present at an Annual Meeting, but the date is an awkward one for anyone whose first and foremost duty is that of a university professor. One of these days I shall arrange to get freedom for a spell in order to attend, but in view of the claims of the Department, it is not easy to do so normally during term-time."

TERMINOLOGY OF CERAMIC WHITEWARE

By Arthur S. Watts

The following note is presented in order to record in the literature of the American Ceramic Society such conclusions as I have reached after more than ten years' critical survey of the subject:

Porcelain *Origin:* Italian from "porcellana," a mollusk having a cream or white and very translucent shell.

Definition: A white or light colored ceramic body of extreme vitrification, translucent in thin sections, either unglazed or covered with a high fusing glaze of moderate brilliancy and pronounced resistance to abrasion.

Varieties: (1) Art porcelain, in which other properties of the body except vitrification are sacrificed for surface texture, or for translucency or color as the particular article may demand. (2) Service porcelain, for tableware, in which other properties of the body except vitrification are more or less sacrificed for translucency or pure color or both. (3) Industrial porcelains, in which other properties of the body except vitrification are sacrificed for mechanical strength. (4) Electrical porcelains, in which other properties of the body are sacrificed for dielectric and mechanical strength. (5) Chemical porcelains, in which other properties of the body except vitrification are sacrificed for extreme resistance to elevated temperatures and sudden temperature changes. (6) Sanitary and architectural (tile) porcelains, same as industrial porcelains, but body color is generally important.

China *Origin:* English, a contraction of chinaware.

Definition: A white or light colored ceramic body of various types possessing moderate to extreme vitrification, and moderate to extreme translucency in thin sections. All types are covered with a moderately fusible glaze of pronounced brilliancy but of variable, moderate to weak, resistance to abrasion.

Types: (1) Bone china, sometimes called English china, having a white body of 2 to 0% water absorption, extreme translucency, and a glaze of weak resistance to abrasion. (2) Belleek china, having an ivory-tinted body of zero water absorption, extreme translucency and a glaze of weak resistance to abrasion. (3) American vitreous china, sometimes called hotel china, having a tinted ivory to white body of less than 1% water absorption, moderate translucency, and a glaze of less brilliancy than other chinas but of greater resistance to abrasion. (4) Sanitary china, having a commercially white body of less than 4% water absorption, weak translucency, and a glaze of moderate resistance to abrasion.

Semichina Same description as sanitary china, but employed as service ware and as architectural ware (tile).

Varieties: Include art, service, sanitary, and architectural chinas which have the same descriptions as porcelains.

Fine Earthenware *Origin:* Probably English.

Definition: A white or colored, artificially compounded porous ceramic body of not exceeding 10% water absorption, practically no translucency even in thin sections, and covered with a glaze of pronounced brilliancy and moderate to weak resistance to abrasion.

Types: (1) White semiporcelain (American misnomer) or white earthenware (English) having a white body due to the absence of discoloring impurities. (2) Ivory earthenware (American) or Queensware (English) having a light cream or ivory colored body due to the color of clays employed.

Varieties: (1) Fine art earthenware of both types of body but covered with a variety of glazes of different surface character and different resistance to abrasion. (2) Fine service earthenware, of both types of body but covered with a glaze of moderate resistance to abrasion. (3) Fine architectural earthenware (wall tile) of both types but covered with a glaze of weak resistance to abrasion.

Note: No attempt is made at this time to define ware in this group having bodies capable of more than 10% water absorption. No attempt is made to define separately the semichinas and the sanitary chinas, although justification is evident.

Department of Ceramic Engineering
Ohio State University
Columbus, Ohio

PERRY HELSER AND PROFESSOR PARMELEE ENJOYED OUR ANNUAL MEETING

On February 20, 1934, Professor Parmelee wrote to the Secretary of the Society as follows: "I wish to congratulate you heartily on the success of the Meeting. I think that it was one of the best we have had, both as to quality and number of papers. Further, the Local Committee did an excellent job in making arrangements for the comfort and entertainment of those in attendance."

Mr. Helser of the General Ceramics Company, New York, made the following statement: "I wish to extend my most sincere congratulations to you and your very efficient staff on the successful Annual Meeting held in Cincinnati. The program was interesting and educational throughout and all with whom I talked enjoyed the Meeting thoroughly."

NEW EXHIBITS IN OFFICES OF THE AMERICAN CERAMIC SOCIETY

Federal Glass Company, Homer Laughlin Ovenserve Ware, Shearwater Pottery, and Newomb Pottery

Because of the continued interest of our members in the permanent exhibit of ceramic ware in the offices of the American Ceramic Society, it has been necessary to add nearly one hundred feet of shelving space.

Federal Glass Early in February, W. E. Barry and J. B. Morehouse of the Federal Glass Company set up an interesting exhibit of pressed and hand-blown and hand-decorated ware. Some of the hand-blown pieces are completed to the point where they are ready to be placed in the leer. There are three sizes of "hang-over" sets decorated in platinum, a Shanghai set, and various other types of hand-blown liquor glasses. The dinnerware set of pressed glass is in golden glow and these sets are also made in crystal and green.

J. M. Beatty, formerly of Steubenville and Tiffin, is owner of this company which has been in operation in Columbus for twenty-five years. Six continuous tanks are in operation at this plant.

Shearwater Art Pottery From Ocean Springs, Miss., east of Biloxi, a number of pieces of Shearwater pottery was sent to the office by Mr. Purdy. There are half a dozen figurines of negroes depicting some of the more amusing characteristics of the negro in gay native costume.

Of the Anderson brothers operating this plant, Mr. Purdy wrote as follows:

> The Shearwater Art Pottery is operated by three Anderson brothers in the pine woods. Their mother is a trained artist. The older brother studied with Ned Curtis and spent one summer at Alfred. The other two boys just "grew" into potters. They have an Alfred boy working for them. All of them seem to comprehend the philosophy of body, glaze, and color compounding. They are making an unusual line of craft pottery. They are also making underglaze decorated tile panels for a local school, designing and executing very fine panels which depict things of local setting. Not one of these boys is out of his twenties. They are doing things; it is their fun and work. All that they have, they have acquired and saved. They will be heard from. One of the boys asked if I would send him a reprint of my paper which I wrote on crystalline glazes in 1907. They said that they had read everything published by the Society on mat glazes and had obtained the greatest success when they followed the philosophy of mat glaze which I published.
>
> With Curtis at Philadelphia, at Alfred, and at Newcomb they have read the *Transactions* and *Journals* with comprehension. They surprised me with the knowledge they possess and have successfully applied.
>
> None of them had ever seen me, yet the elder brother immediately spoke my name when I opened the door. There was not the slightest hesitation in that recognition and he did not know that I was going to call on him. Those boys made a strong impression on me by their alert minds and creative ability. They are fine illustrations of the fact that success in ceramics is dependent more on the inborn capabilities and energy of men than on the amount of formal schooling obtained.

Newcomb Pottery Two examples of the famous Newcomb Pottery pieces are now on the exhibit shelves. One is a bright glaze and the other a mat glaze, both of them with the characteristic underglaze Spanish moss wood scenes.

Ovenserve Ware The Homer Laughlin China Company has sent eight pieces of hand-decorated ovenware, a creation of that productive team, Bleininger and Rhead. This ware represents a new field for "semiporcelain" china and for this reason this exhibit has a historical value and significance.

LETTERS DISCUSSING CERAMIC EDUCATION

Communication from J. L. Morrill

April 13, 1934

My dear Mr. Purdy:

President Rightmire asks me to thank you for the mimeographed* statement on "Specialization in Collegiate Education" dealing especially with ceramic education, which you were kind enough to send. He was much interested to have it.

Fortunately it came to me just a few days before a visit of six or seven hours with Charles Kettering in Detroit which I was privileged to have. I had the benefit of hearing Mr. Kettering's very stimulating and original ideas about education in general and engineering education in particular.

You may be interested to know that his own theories go along very well with yours in some respects and depart very sharply from yours in others.

On page two of your memorandum you quote Kenneth Roberts as defining "a trained mind" in two paragraphs which you picked out of the *Saturday Evening Post* of March 31. I read that article too and it is my definite recollection that the definition which you quote was not Roberts' definition at all, but was the definition of a bunch of arts college professors whom he interviewed (I happen to know) at Michigan. Personally, the definition is all right with me but I am growing somewhat skeptical of education by definition and I have a suspicion that vocational objectives are the soundest objectives after all for any educational program.

Last Saturday I heard an interesting address by Robert Kelly, Secretary of the Association of American Universities, which is the group of traditional liberal arts colleges in the country. Kelly inveighed against anything smacking of vocational education, pleading for a return and for steadfast adherence to the old cultural subject matter, etc. I had a vague impression, in listening to him, of somebody whistling in a graveyard from which the whistler saw no way of escape in the darkness.

Perhaps you would have agreed with that impression—and I say this judging from some of the things in your memorandum—but I think that practically speaking your memorandum tends to support the Kelly point of view.

Sincerely yours,

J. L. MORRILL, *Vice President Ohio State University*

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* See Editorial, this issue, p. 115.

Reply by Mr. Purdy, April 16, 1934

My dear Lew:

Thanks for your frank expression of opinion. It must be you have not seen my other communications on this same subject or you would have known that I too believe in vocational objectives in collegiate curricula. Galley proof of my May editorial is attached hereto that you may see to what extent I believe in vocational objectives in collegiate curricula. My belief in vocational objectives was restated in the first paragraph of the editorial which Dr. Rightmire had you read.

I would like to know in what respects, in your opinion, Dr. Kettering's views differ from mine. I, too, have conversed with him and I have read statements of his opinions. It seems to me that he and I are very much in agreement.

I could not agree with Mr. Kelly, as quoted by you, that there should be no vocational objectives in college curricula but I do believe with him that the burden of the curricula should be cultural, provided we agree on what is cultural. I believe that for doctors the premedical curriculum, consisting as it does of the sciences that are essential to a broad foundation for training of minds of prospective physicians, is a cultural course of study. I take it that Roberts had the right idea of the training essential to success in journalism. A mind trained to do analytical thinking is a cultured mind.

College curricula, it seems to me, should be so designed as to give students the fundamentals of whatever vocation they elect. I believe Professor Watts to be in error when he styles as "fundamentals in ceramics" the widely published and readily obtainable empirical information of ceramic compositions and plant practices. Such information is of value, not as mind-training material, but only for factory practices. To ask pupils to cram a lot of such information into their memories is not training their minds to search and apply the science fundamentals which pertain, as a graduate certainly must do if he advances himself and makes additions to ceramic knowledge.

I hope that you will study and let us have your opinion of collegiate engineering curricula in which the science essentials are being crowded out to give place to recitals on and laboratory practices in empirical vocational information such as characterize trade-school curricula. Sad to relate, too much of our engineering curricula is of this trade-school sort.

Beauty in Ceramic Ware

The following letter has been received from Glen Lukens of the Department of Ceramics, College of Architecture and Fine Arts, University of Southern California, Los Angeles. Under date of March 2, 1934, Professor Lukens writes:

In the February, 1934, issue of *The Bulletin*, an editorial entitled "Collegiate Ceramic Education" appeared. It carried a plea for the extension of ceramic education into the universities of all of the states of the Union, the burden of the theme being along lines of technology for the promotion of that phase of ceramic work in America. Not one word was used to encourage beauty in American ceramic production. Ceramic art is the one lagging child among the industries when it comes to beauty. An article of use may have both beauty and use, or if it has not beauty, at least it need not be ugly.

I have had the discouraging experience of traveling over Europe and America in the interest of fine ceramic art, and have concluded, as others have done, that if America is to achieve true greatness in the ceramic industry, it will not be through a few artists, but through the spirit of art entering into the life of the people through the common everyday things they use.

I have hoped for years that the American Ceramic Society would start a campaign to give art a chance to show what it can do in ceramics. It has already proved its value in one field of ceramic art, namely, the glass industry. Why not turn it loose in the potteries, and permit it to work hand in hand with technique, and observe the result?

There are many fine designers in America who would be eager and happy to work with master technicians, and thus give new meaning and interpretations to this vast fund of technical knowledge that has accumulated through the years.

Homer F. Staley Writes

On March 12, Mr. Staley made the following statement in regard to the current discussion on ceramic education:

I have been very much interested in your communications in regard to the necessity for reform in the curricula in the ceramic schools. I admire your courage and energy and hope that you may be able to do something in this regard. As you may remember, I worked very hard for three or four years on this same project, but found the heads of the various ceramic departments absolutely immune to suggestions.

NEW MEMBERS RECEIVED IN MARCH

CORPORATION

Buck Glass Company, R. A. Blunt (voter), Fort Ave. and Lawrence St., Baltimore, Md.

Ferro Enamel Corporation, R. A. Weaver (voter), 4150 E. 56th St., Cleveland, Ohio.

PERSONAL

S. N. Agarwal, Joachim Friedrich Str. 7, Berlin-Halensee, Germany.

J. C. Eckel, American Sheet & Tin Plate Co., Frick Bldg., Pittsburgh, Pa.

Edward F. Groeniger, Practicing Engineer, 50 W. Broad St., Columbus, Ohio.

William D. Harkins, Professor of Chemistry, Kent Chemical Laboratory, University of Chicago, Chicago, Ill.

R. W. Hemphill, Superintendent Colonial Insulator Co., 973 Grant St., Akron, Ohio.

E. W. Trexler, Combustion Engineer, Bethlehem Steel Co., Johnstown, Pa.

STUDENT

Frederick M. Armstrong, University of Illinois.

Membership Workers' Record

Personal		Corporation	
J. C. Hostetter	1	Office	2
W. Keith McAfee	1		
W. Steger	1	Student	
Office	3	R. K. Hursh	1
Total	6	Total	3
		Grand Total	9

Glenn Hutt, formerly of Frigidaire Corporation Porcelain Plant, Dayton, Ohio, has joined the Service Staff of Ferro Enamel Corporation, Cleveland, Ohio.

OFFICIAL PERSONNEL FOR 1934–1935

	Art	Enamel	Glass	Materials and Equipment	Refractories	Structural Clay Products	Terra Cotta	White Wares
Trustee	F. H. Rhead	W. C. Lindemann	F. C. Flint	V. V. Kelsey	R. B. Sosman	R. B. Keplinger	R. L. Clare	D. Parry Forst
Chairman	L. E. Barringer	W. N. Harrison	James Bailey	R. C. Meeker	H. E. White	J. L. Carruthers	H. D. Callahan	Edward Schramm
Vice-Chairman	H. S. Nash		U. E. Bowes	C. H. Peddrick, Jr.	R. B. Sosman			
Secretary	Charles Harder	B. J. Sweo	F. C. Flint	H. B. DuBois	R. E. Birch	D. A. Moulton	H. E. Davis	T. A. Klinefelter
Research	Paul E. Cox	R. M. King	G. W. Morey	F. P. Knight, Jr.	D. W. Ross	H. R. Straight	Hewitt Wilson	F. P. Hall
Standards *(a) Tests* *(b) Products*	(*a*) E. deF. Curtis (*b*) W. J. Stephani	(*a*) D. G. Bennett	(*a*) W. C. Taylor (*b*) W. F. Curtis	(*a*) Tom Falknor (*b*) B. C. Burgess	(*a*) R. S. Bradley (*b*) E. H. Van Schoick	(*a*) J. W. Whittemore (*b*) H. D. Foster	(*a*) H. E. Davis (*b*) H. G. Schurecht	(*a*) A. V. Bleininger (*b*) P. D. Helser
Membership	Mary G. Sheerer		R. A. Miller	Fred Stanger	A. E. R. Westman	J. O. Everhart	Thad O. Smith	Leslie Brown
Data	K. E. Smith		A. N. Finn	C. W. Gerster	G. J. Bair	T. W. Garve		F. P. Knight, Jr.
Education	Charles Harder	H. G. Wolfram	S. R. Scholes	John T. Jans	F. A. Harvey	G. A. Bole	J. L. Carruthers	A. S. Watts
Papers and Program	Arthur Baggs H. S. Nash	R. R. Danielson	U. E. Bowes	G. H. Brown	H. M. Kraner K. E. Buck	W. H. Vaughan	H. D. Callahan W. L. Howat	F. P. Hall C. W. Parmelee
Rules	F. H. Rhead	R. D. Landrum	E. L. Hettinger	R. B. Carothers	N. W. Taylor D. W. Ross E. H. Van Schoick	Howells Fréchette	W. J. Stephani	T. A. Klinefelter F. H. Norton
Exhibitions	Marion L. Fosdick							V. J. Roehm
Councillors		Frank Hodek R. B. Schaal	G. W. Morey Herbert Insley	G. H. Brown				
Nominations	M. M. French Arthur Baggs Marion L. Fosdick	Erwin Sohn B. T. Sweely	E. W. Tillotson J. T. Littleton	H. F. Kleinfeldt F. G. Lord	S. M. Phelps R. A. Heindl	H. C. Kleymeyer G. W. Denison	O. E. Mathiasen W. J. Stephani	Robert Twells G. A. Loomis
Advisor	R. Guy Cowan			Philip Dressler				
Editorial	Charles F. Binns Charles Harder Arthur Baggs	B. T. Sweely T. D. Hartshorn R. D. Cooke	G. V. McCauley G. E. F. Lundell E. W. Tillotson	C. E. Parmelee F. A. Guignon C. C. Treischel	H. E. White D. W. Ross R. B. Sosman	John D. Martin W. C. Rueckel Ellis Lovejoy	E. C. Hill H. G. Schurecht	G. H. Brown S. J. McDowell R. F. Geller
Management	F. H. Rhead	R. A. Weaver		R. L. Cawood	C. E. Bales	C. F. Tefft		E. H. Fritz
			Summer Meeting J. T. Littleton A. W. Kimes U. E. Bowes	*Statistics* V. V. Kelsey R. B. Carothers F. G. Lord George Simcoe B. T. Bonnot R. W. Rowland				*Statistics* J. D. Whitmer J. W. Hepplewhite V. S. Schory H. C. Harrison George Crawford

A DANGER

Your Society is called upon to render service that will exceed the budget allowance. Not even the expenditures as now budgeted can be met unless the Society has more financial income from members and advertising.

This is your problem. What will you do?

LOCAL SECTION NEWS

Michigan-Northwestern Ohio

A dinner meeting of the Michigan-Northwestern Ohio Section was held at the Oasis Club, Detroit, April 20, 1934.

The subject of refractory insulating brick was discussed. H. M. Christman and H. R. Orwick of the Massillon Refractories Company presented a joint paper on "Future Furnaces and Their Refractories." The discussion following was led by A. B. Curtis of the Johns-Manville Corporation.

Special invitations were extended to members of the Steel Treaters' Association in the Detroit district as well as to all local refractories men.

Pacific-Northwest Section

The following program of papers was presented at the 1934 Annual Meeting of the Pacific-Northwest Section on May 5, 1934.

1. The Effect of a Vacuum Treatment on Several Washington Clays. By Gordon Anderson, who has constructed a laboratory vacuum brick machine and tested a number of local clays with this treatment.
2. Diatomite of Washington and Its Possible Uses. By H. E. Sovereign, former engineer in charge of construction of the Shuffleton Power Plant, construction engineer with the Penoles Mining Co., Monterrey, N. L., Mexico, and former consulting engineer for steam power problems for the city of Seattle.
3. Talc and Soapstone in the Skagit River Valley. By M. W. Jasper, mining engineer, now making a study of the nonmetallics in Skagit County for C. W. A.
4. The New Navy Simulative Service Test Furnace. By G. L. Rogers, engineer for Gladding, McBean & Co. The latest type of furnaces have been constructed at the Renton, Wash., plant of this company.
5. A Demonstration in the Art of "Throwing" Stoneware Pottery. By J. T. Thurman, production manager of the Pacific Stoneware Co., Portland, Ore.
6. Tests of Two New Scum Eliminators; Barium Aluminate and Barium Zeolite. By Gordon Anderson.
7. Problems in the Firing of Common Brick Kilns with Wood. By J. A. Cunliffe, who revised the kilns and firing schedule at the Port Haney Brick Co., Port Haney, B. C.
8. Refractories, the Viewpoint of a Consumer. By G. H. Kruger, mechanical and construction engineer for a number of Northwest power plants.

Pittsburgh Section

A meeting of the Pittsburgh Section was held at Mellon Institute on April 10. J. E. Hansen of the Ferro Enamel Corporation of Cleveland spoke on recent developments in the enamel industry.

In spite of the depression, the enamel industry has had a steadily increasing volume, as reflected in the sales of prepared frits. This is due in part to the preference for prepared frits in wet-process plants, but mainly to the development of new products made of enameled metal. These new products such as refrigerators, stoves, and architectural units have demanded greater acid resistance which has been met. The high fabricating costs and lack of outlets for seconds has also necessitated the introduction of deënameling.

These high-value products have accentuated the problem of adherence which is being studied in a systematic way at Ohio State University. Technological developments have increased more rapidly than plant practice, and this will be corrected by having more papers at the next Annual Meeting of the Society dealing with practical phases of the industry.

In the discussion, which centered mostly around the theory of adherence, Nelson W. Taylor told of evidence of reaction between the enamel and metal which has been obtained at Pennsylvania State College. R. E. Stark described the methods employed in the jewelry industry for obtaining adherence to the noble metals where no oxide film can be developed. Physical assistance must be given, including a clever use of atmospheric pressure. F. W. Preston pointed out that the function of cobalt should be firmly established, and J. E. Rosenberg suggested that this could be done by attempting to enamel on metallic cobalt. Theoretically, this should be impossible and Mr. Rosenberg will make such attempts and report at a later meeting.

R. F. Ferguson,
Secretary, Pittsburgh Section

ALFRED UNIVERSITY SUMMER CERAMIC SCHOOL

By Dean M. E. Holmes

The New York State College of Ceramics is sponsoring a Ceramic Summer School which will be held at Alfred University from July 2 to August 10. It is believed that there is enough of a demand in this country for ceramic instruction during the summer to support one summer school. High-school teachers of ceramic art, technical and non-technical workers from the ceramic industries, students from other institutions having work to make up, and graduates not employed will find in this summer school opportunities to obtain instruction in regular and special courses in ceramic art, technology, and engineering.

Attention is called to the fact that the summers at Alfred are cool and pleasant in every way. The high altitude precludes hot weather. Golf courses are available at nearby towns as are also facilities for swimming, horseback riding, and tennis. Living expenses are very moderate.

The faculty consists of C. F. Binns, S. R. Scholes, C. R. Amberg, M. J. Rice, R. W. Campbell, C. W. Merritt, and H. S. Nash of the University of Cincinnati.

The courses of instruction include lectures and laboratory in the following subjects: general ceramic technology, whitewares, enamels, petrography, X-ray analysis, raw materials for glass, glassworking and melting processes, general design and pottery production, jewelry and metal work, and weaving.

In addition to the ceramic courses listed, the Liberal Arts College of Alfred University offers courses in biology, physiology, inorganic, organic, and analytical chemistry, drafting, economics, education, English, history, French, German, mathematics, physics, Spanish, and psychology.

Detailed information may be obtained by addressing Waldo A. Titsworth, Director of the Summer School, Alfred, New York.

Penn State Student Branch of the American Ceramic Society

Maize, Gibson, Jacobs, Tomkins, Cleaves, Bachman, Wilson
Samuel, Wertz, Condon, Whittaker, Robinson, Munro, Mohr
Bair, Smith, Dr. Taylor, Milliken, Fairchild, McCloskey, Cole, Dr. Williams

Penn State Student Branch*

Those of this group who were fortunate enough to attend the Annual Meeting in Cincinnati not only greatly enjoyed it, but profited by it as well. The only regret is that more of the students could not have been present.

Ceramic Demonstration On March 21, the Mineral Industry School held an open house which proved to be a great success. The Ceramic Department played a prominent part, each student giving a demonstration of some phase of ceramic work, besides special features offered by various ceramic companies.

Trip to Corning Glass Works On March 25, the juniors, seniors, and faculty members of this Branch witnessed the pouring of the 200-inch lens at the Corning Glass Works and were also taken on an inspection tour of the plant.

G. R. Pole Speaker Gordon R. Pole, candidate for a Ph.D. degree at Penn State and formerly with the Bureau of Standards, was the speaker at the March meeting, his topic being "Weathering of Terra Cotta." Dr. Scholes of the New York State College of Ceramics spoke at a dinner meeting on April 20.

H. G. Wolfram Speaker At the last meeting of the year on April 20, Harold G. Wolfram of the Porcelain Enamel & Manufacturing Company gave a talk. A social gathering was held following the meeting.

CERAMIC ENGINEERS AT UNIVERSITY OF NORTH CAROLINA WIN HONORS

Engineers' Celebration The annual Engineers' Celebration at the Raleigh unit of the University of North Carolina was held during the latter half of the week of April 1. The exhibit of the Department of Ceramic Engineering was one of the best ever put on and was given second place in the competition for the cup for the best departmental exhibit. More than 3000 visitors passed through the department on Fair Day.

As usual the exhibit of artware made by the members of the Student Branch of the Society out of class hours was the center of interest. The exhibit contained more than 150 pieces. An individual exhibit of 50 pieces made by W. R. McLain, president of the Student Branch, won the second individual award.

The demonstration of enameling sheet steel attracted much interest. Plates in red and white enamel, the College colors, were sprayed and fired and presented to visitors.

In the main laboratories dry-press floor tile were made and a complete art pottery plant was in operation showing the process in all stages from the mixing of raw materials to kilns under full fire.

One room was given over to an exhibit of ceramic products including glass, sanitary ware, refractories, structural products, electrical and chemical porcelains, floor and wall tile, and ceramic materials.

In the annual Engineers' torchlight parade, the ceramic engineers followed a float containing a huge replica of the Keramos key.

Honors for Ceramic Students The annual Scholarship Day on April 11 found the ceramic engineers holding a prominent place.

Members of every class were on the roll of honor and the seniors were particularly in evidence with every member of the class on the list. This is the first time such a thing has occurred in any department of the institution.

The J. C. Steele Scholarship Cup presented each year by the J. C. Steele and Sons Company of Statesville, N. C., to the upper classman with the highest average grade was awarded to T. L. Hurst of Leonia, N. J.

The Moland-Drysdale cup presented each year by the Moland-Drysdale Corporation of Hendersonville, N. C.,

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* From Theodore Fairchild, Secretary.

to the freshman with the highest average grade was awarded to A. R. Blackburn of Wilson, N. C.

Both students had grades above 92 out of a possible 95 and were awarded high honors.

Student Branch Elects Officers At the annual election of officers of the Student Branch of the American Ceramic Society the following students were elected to handle the affairs of the organization during the next academic year:

President, W. R. McLain; *Vice-President*, R. Barnes Worth; *Secretary*, A. R. Lloyd; *Treasurer*, H. M. Hamburger; *Member-at-large on Engineers Council*, E. B. Smith; and *Junior Alternate to Engineers Council*, T. L. Hurst.

Ohio State University Alumni News*

At the 36th Annual Meeting of the American Ceramic Society held in Cincinnati, February 11 to 16, Albert V. Bleininger (Cer. '01, Cer. Engr. '31) was given a Life Membership in the Society with the other nine living Charter Members.

The Edward Orton, Jr., Memorial Lecture, given under the auspices of the Fellows of the Society, was delivered by Arthur L. Day of the Geophysical Laboratory, Washington, D. C. This lecture given annually is in honor of Edward Orton, Jr. (E.M. '84) founder of the Department of Ceramic Engineering and for years the guiding genius of the American Ceramic Society.

Among the officers of the Society are Ross C. Purdy (Cer. '08), General Secretary; H. B. Henderson (Phar. '04), Treasurer; and R. L. Clare (Cer. '12) and D. Parry Forst (Cer.. w. '17), Trustees. John D. Martin (M.E. '01, Cer. Engr. '31) is President of the National Brick Manufacturer's Research Foundation which held its meeting in conjunction with the Society.

L. E. Barringer (Cer. '02, Cer.Engr. '33) was Dean of the Fellows of the Society for the past year and also Chairman of the Art Division. G. H. Brown (Cer. '08, Cer.Engr. '33), J. O. Everhart (Cer. '28), and R. F. Grady, Jr. (Cer. '26) were Chairmen of the Materials and Equipment, Structural Clay Products, and Terra Cotta Divisions. H. E. Davis (Cer. '19), R. E. Birch (Cer. '27), Ercill Hill (Cer. '11), R. M. King (M.Sc. '23), and W. C. Rueckel (Cer. '29, Ph.D. '33) were active as secretaries and program chairmen in various Divisions. H. M. Kraner (Cer. '21, M.Sc. '23) and Glenn A. Hutt (Cer. '30) were members of the Local Committee.

Professors Watts (Cer.Engr. '28), King (M.Sc. '23), Carruthers (Cer. '21), Bole, and McSwiney of the Ceramic Engineering faculty were co-authors and authors of papers delivered at the Meeting. Professor Bibber of the Electrical Engineering Department and Prof. J. O. Lord (B.Ch.E. '15) of the Metallurgy Department also presented papers.

The following graduates of the Ceramic Engineering Department were authors or co-authors of thirty-three papers presented at the Meeting: A. S. Watts (Cer. Engr. '28), R. M. King (M.Sc. '23), H. H. Holscher (Ph.D.'31), K. Kautz (Cer.Engr.'31), H. E. Simpson (Ph.D. '29), W. C. Rueckel (Ph.D. '33), R. Russell, Jr. (M.Sc.'33), H. Thiemecke (M.Sc. '31), H. L. Latimer (M.Sc. '33), C. J. Koenig (M.Sc. '33), G. H. Spencer-Strong (M.Sc. '31), R. L. Clare (Cer. '12), T. A. Klinefelter (Cer. '15), J. S. Gregorius (Cer. '20), J. L. Carruthers (Cer. '21), F. M. Hartford (w. '20), J. O. Everhart (B.Cer.E. '28), Hewitt Wilson (Cer. '13), G. E. Terry (Cer. '33), E. A. Durbin (Cer. '33), D. A. Moulton (Cer. '08), G. A. Wills (Cer. '27).

Graduates of other departments presenting papers were Ellis Lovejoy (E.M. '88), R. B. Sosman (B.Sci. '03), A. I. Andrews (Ph.D. '24).

An Ohio State Dinner was held February 13, which was attended by seventy graduates. A survey of those attending the Meeting showed 97 graduates and 11 students of the Ceramic Engineering Department, and 20 or more graduates of other departments of Ohio State.

The call for ceramic graduates continues. Practically all graduates of the past few years who could not obtain satisfactory ceramic positions have now been placed, and the same is true of the graduates who lost their positions due to the depression. Some calls for men with special training or experience remain unfilled due to no available men. Since February 1, 1934, the following men have accepted new positions:

Adrian G. Allison, '32, Research Fellowship, Engineering Experiment Station, Campus.
Donald W. Armstrong, '31, Benjamin Electric Company, Des Plaines, Illinois.
Donald L. Bensinger, '31, Fletcher Electric Co., Dunbar, W. Va.
Arthur L. Donnenwirth, '22, Carborundum Company, Niagara Falls, N. Y.
Lewis C. Farrow, '33, Ferro Enameling Co., Cleveland, Ohio.
Frank W. Gunther, '20, Mapleton Clay Products Co., Mapleton, Ohio.
Walter B. Hayes, '31, Davidson Enamel Co., Clyde, Ohio.
Carl E. Kaiser, '33, Chicago Vitreous Enamel Product Company, Cicero, Illinois.
Lewis H. Keller, M.Sc., '33, Owens-Illinois Glass Company, Columbus, Ohio.
Burnham W. King, Jr., M.Sc., '33, General Electric Company, Schenectady, N. Y.
Melvin S. Lund, '29, Allied Engineering Co., Cleveland, Ohio.
Frederick R. Neel, '31, Continental Stove Co., Ironton, Ohio.
Burton E. Peck, '33, Robinson Clay Products Co., Dover, Ohio.
Edgar D. Riebel, '33, Frigidaire Corp., Dayton, Ohio.
Edward C. Seabright, '30, Electromaster Corp., Detroit, Mich.
Walter H. Schotts, '27, Allied Engineering Co., Cleveland, Ohio.
L. Kern Sosey, '32, Frigidaire Corp., Dayton, Ohio.
Cecil H. Turner, '33, O. Hommel Company, Pittsburgh, Pa.
Drury D. Turner, '28, Haeger Potteries, Dundee, Illinois.
Norman G. Wedemeyer, '30, Böhm and Haas, Philadelphia, Pa.
Haven M. Zimmerman, '32, Davidson Enamel Co., Lima, Ohio.

The department also provided the contact through which H. Leslie Moody, graduate in Ceramic Art, has located with the Abingdon Sanitary Mfg. Co., Abingdon, Illinois.

The above makes a total of 66 graduates in new positions announced through the Ceramic Engineering Department during the current school year. Five additional applications for ceramic engineers are now on hand and negotiations under way.

TWO DIVISIONS OF THE OHIO CERAMIC INDUSTRIES ASSOCIATION HOLD MEETINGS IN MAY

The Whitewares Division of the Ohio Ceramic Industries Association will hold a joint meeting with the Pittsburgh Section of the American Ceramic Society and the Ceramic Engineers Club of East Liverpool, Ohio, at the New Castle Field Club, New Castle, Pennsylvania on May 22, 1934.

The Heavy Clay Products Division will hold its spring meeting at the Shady Hollow Country Club at Massillon Ohio, May 24, 1934.

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* From Arthur S. Watts, Chairman, Ceramic Engineering Department.

GRADUATING CLASS OF 1934 IN GLASS TECHNOLOGY AND GENERAL CERAMIC TECHNOLOGY AT THE NEW YORK STATE COLLEGE OF CERAMICS, ALFRED UNIVERSITY, ALFRED, NEW YORK

1. Walter Tolbert, Elmira, N. Y. (*g*)
2. Whitney Kuenn, Franklinville, N. Y. (*g*)
3. Alva Arwine, Hornell, N. Y. (*g*)
4. William Kingsley, Newburgh, N. Y. (*c*)
5. Lawrence Hopper, Buffalo, N. Y. (*c*)
6. Michael Chous, Spring Valley, N. Y. (*c*)
7. Donald Morris, Conesus, N. Y. (*g*)
8. Cornelius Turner, Newburgh, N. Y. (*c*)
9. Eugene Deegan, Elmira, N. Y. (*c*)
10. Adolph Reitz, Bolivar, N. Y. (*c*)
11. Glenn Gregory, Skaneateles, N. Y. (*g*)
12. Earl Beeton, Alfred, N. Y. (*p*)
13. Lee Armstrong, Alfred, N. Y. (*p*)
14. Richard Ricker, Galion, Ohio (*g*)
15. Benjamin Dewey, Wellsville, N. Y. (*c*)
16. Lester Henry, Hornell, N. Y. (*g*)
17. Earl Davis, Rushford, N. Y. (*g*)
18. Theodore Ten Broeck, Newburgh, N. Y. (*g*)
19. Ross Cibella, Rochester, N. Y. (*g*)
20. Vincent Wessels, Avoca, N. Y. (*g*)
21. Crawford Hallett, Canisteo, N. Y. (*g*)
22. Vincent Young, Buffalo, N. Y. (*g*)

(*g*) Glass Technology.
(*c*) General Ceramic Technology.
(*p*) Post-Graduate in General Ceramic Technology.

New York State College of Ceramics

Student Branch The student branch of the American Ceramic Society has been holding regular monthly meetings all winter. At the March meeting, President W. Keith McAfee was the speaker. He gave a highly interesting address on the manufacture of sanitary ware and also gave the students some splendid advice on what the industry expects of them. About 150 attended this meeting. Other meetings this year were addressed most capably by A. V. Bleininger and James Bailey. The officers of the student branch are Whitney Kuenn, T. R. Ten Broeck, Ross Cibella, and Adolph Reitz.

The College was represented at the Cincinnati Meeting by six members of the faculty and ten seniors. The students here are completely "sold" on the benefits to be derived from attending the Annual Meeting of the Society.

Social Activities The celebration this year in honor of St. Patrick, the patron saint of engineers, was an outstanding success. St. Patrick knighted all the seniors, four alumni, and two honorary members, one of whom was J. C. Hostetter. The parade consisted of twenty floats depicting the humorous side of college life at Alfred. The open-house was attended by about 800 visitors from the western part of New York who saw the laboratories in use with the students at their regular tasks under the direction of their instructors. The Corning Glass Works also put on an exhibit of glassblowing. The *tea dansant* in the Ceramic College was attended by 100 couples and the formal St. Patrick ball by 175 couples.

Graduation for 1934 The graduating class this year consists of nineteen seniors and three post-graduates in glass technology and general ceramic engineering. There will also be eighteen graduates in ceramic art. This graduating class is noteworthy in that it includes the first glass technologists to be graduated.

N. Y. Ceramic Association Plans are under way for the Convention of the Ceramic Association of New York which will be held in the New Ceramic College Building on May 25. Every one interested in the work of this Association is invited to attend.

State Fair Exhibit An exhibit is being prepared for display at the New York State Fair this year. The exhibit will consist of glassblowing, pottery throwing and jiggering, products of the ceramic companies of the State, and educational charts and displays.

Short Course in May This spring a short course for men from the industries will be initiated. It is tentatively scheduled for the week of May 20. General courses in ceramics, special courses in petrography, glass technology, chemistry, and mineralogy will be offered.

JAMES T. ROBSON WITH FERRO ENAMEL CORPORATION

J. T. Robson has been named to an important post in the Ferro Enamel Corporation of Cleveland, Ohio. With new control, research, and development laboratories having just been built by Ferro, Dr. Robson will direct all laboratory and research activities of the company, including service-work on Ferro porcelain enamels.

Dr. Robson comes from Allied Engineering Company, Columbus, Ohio, which concern was recently taken over as a branch of Ferro Enamel, handling pottery-kiln and glaze lines.

Previously, he was instructor in Ceramic Engineering at Ohio State University in Columbus. Dr. Robson is author of a long list of technical papers which have appeared in leading scientific journals.

NECROLOGY

Carl H. Zwermann

Carl H. Zwermann passed away at his home in Robinson, Illinois, on March 30 after a serious illness of ten months.

Mr. Zwermann was born October 20, 1876 in Wehrheim, Germany, where he received his early education, and learned the enameling business at an early age. At the age of eighteen he came to this country locating in Baltimore, Maryland where he worked in an enameling plant, first for his uncle, and later for McShane's, constructing an enameling plant for the latter concern. At the same time he studied engineering, chemistry, and kindred subjects thereby building up his framework of technical knowledge.

CARL H. ZWERMANN

In 1901 he returned to Germany as a consulting engineer. During this period he constructed enameling plants in Russia, Germany, and Scotland.

Upon his return to this country he located in Kalamazoo, Michigan, in 1905 where he organized the Kalamazoo Enameling Works for the manufacture of enameled water-closet tanks. In 1916 he organized the Kalamazoo Sanitary Manufacturing Company for the manufacture of vitreous china sanitary ware. In this plant he built car tunnel kilns embodying designs of his own.

In 1918, he sold out his interests in this company, and moved to Newark, Ohio, where for a year he acted as consulting engineer in the construction of Zwermann tunnel kilns.

In 1919, Mr. Zwermann moved to Robinson, Illinois, where he organized the Zwermann Company for the manufacture of vitreous china sanitary ware. From a small beginning with Mr. Zwermann's intense energy this plant expanded rapidly, increasing production 900% in five years, and becoming one of the largest plants of its kind in the country. In 1926 Zwermann Company consolidated with the W. A. Case & Son Manufacturing Company of Buffalo, New York. Mr. Zwermann became a director and vice-president of this concern, which positions he held at the time of his death.

During these years Mr. Zwermann patented many inventions which proved useful to the sanitary ware industry. He was a member of the American Ceramic Society for many years, being very active in the Enamel Division in the early years. His wife, three children, Eva and Carl, Jr., of Robinson and Mrs. L. R. Twyman of Detroit, Michigan, and a brother, Theodore Zwermann of Robinson, survive him.

W. Edwin Wells

Funeral services for W. Edwin Wells, superintendent of plant No. 8 of The Homer Laughlin China Company and former president of the United States Potters' Association, whose sudden death last Thursday occasioned much sorrow and regret throughout the industry, were held on April 2 at his home on Newell Heights.

The four plants of the company, with their 3000 or more employees, suspended operations at noon for the services.

Burial took place in a mausoleum at Riverview cemetery, beside his parents, the late Mr. and Mrs. W. E. Wells.

His pallbearers were Charles I. Aaron and Lester I. Aaron of Pittsburgh, vice-president and treasurer, respectively, of the Homer Laughlin China Company; Arthur B. Mayer of the Mayer China Company, Beaver Falls, Pa., president of the United States Potters' Association; Malcolm W. Thompson, secretary of the Hall China Company; Robert Boyce, general manager of the Harker Pottery Company; Richard B. Smith, vice-president of the Taylor, Smith, & Taylor Pottery Company, Chester, W. Va.; Wright Hugus of Wheeling, former state senator of West Virginia; Richard Sant, clay broker of East Liverpool; Lewis Wells, a cousin of Mr. Wells, Colliers, and John Golding, a brother-in-law of Mr. Wells and an executive of the Homer Laughlin China Company.

The *East Liverpool Review* commented editorially on Mr. Well's death as follows:

The death of W. Edwin Wells of Newell, pottery executive, former West Virginia state senator and Republican leader in the Panhandle section of his adopted state, brings sorrow to many homes in East Liverpool, his native city which loved him for his equality of human fellowship.

For 20 years since his graduation from Bethany college, of which he was a trustee and former graduate manager of athletics, Mr. Wells had been actively associated with the Homer Laughlin China Company. Entering the ceramic business under the wise guidance of his late father, W. E. Wells, who for 31 years was the spokesman of the American pottery industry, he won by his ability the general superintendency of the Laughlin interests. And in this position he had the confidence of the hundreds of workers in the various plants who admired him because he was unfailingly human.

Genial in every way, he found employment in athletics. He was a football player during his high school days in East Liverpool and later at Bethany college. He served as mentor of the sport in both institutions. And his protégés loved him not only for his knowledge of the game, but also for the friendly spirit in which he directed them. The same spirit marked his superintendency of the Laughlin potteries.

These qualities were valuable assets when he was president of the United States Potters' Association, and newspapermen and others who came in contact with him found it a pleasure to consult him. His humaneness, kindliness, charity, and capacity for hard work contributed in equal measure to his success as an athletic director, pottery executive, state senator, and Republican party leader. His death is a loss to the ceramic industry, the state of West Virginia, which he ably served, and the East Liverpool district, in the prosperity of which he showed great interest.

NOTES AND NEWS

NEWCOMB POTTERY ACTIVE IN NEW ORLEANS

By Paul E. Cox

I. Founding of Newcomb Pottery

The Trustees of Tulane University are administrators of the fund left by Mrs. Josephine Louise Newcomb for the support of the H. Sophie Newcomb Memorial College, and her will placed the control of the funds in the hands of this group of men. This pottery product has been second only to Rookwood's ware for a period which had its beginning at the time when the South was recovering from the carpetbaggers' régime.

II. Quality of Newcomb Pottery versus Rookwood

Newcomb Pottery's product has never had the quality in body and glaze that Rookwood furnishes, but from the standpoint of decoration and design the Newcomb Pottery product maintains uniformly high standards so that exhibitions the country over accept its pieces and give full approval of them.

Americans should be proud of the history of this strictly American art Pottery and should know the story of the unselfish devotion of its artist staff and its directors.

III. Historical Background

New Orleans is a city of stories. It is a city that finds in leisure the opportunity for doing useful things that are not always remunerative, where money is not worshiped for itself, and where ideas and ambitions are more highly regarded than large bank accounts. It is a city where people are expected to attempt to do unusual and interesting things, and this statement is proved by the list of men and women of genius in letters who have lived there and worked there. It is proved by the long existence of the French opera at a time when most Americans knew nothing of the opera and by the good foods, the laughter of children, and the lazy good nature of the negroes. The Carnival proves it.

It is proved by the successful operation of the Newcomb Pottery.

Most things really grow from seed of some sort and their early years are interesting because they explain the after years.

The Hernandez family were wealthy tobacco brokers who decided to have a porcelain works in New Orleans of the sort subsidized by the royal families of Europe. French workmen, trained to make the ware and to decorate hard porcelain in the style of France, were imported and clay was brought from St. Yrieix. Saggers were made from a clay obtained near Biloxi, and small kilns were built. This factory was located on Carondelet Walk on the Old Basin Canal out toward Lake Ponchartrain. Only a few kilns of ware were made and nothing distinctive was produced. Some of the saggers were used by Newcomb Pottery and were finally broken into grog for making new saggers by the writer of this paper. Traces of the remnants of the shipload of French porcelain clay were noted by the writer in 1914 near the site of the old plant where the material had been used to fill a depression left when the canal levee was thrown up.

Miss Mary G. Sheerer and students of the art class at Newcomb working on pottery. New Orleans, La. © N. G. S. Taken for the National Geographic Magazine, 1929.

One of the potters connected with this Hernandez enterprise became the first thrower employed to make ware at Newcomb Pottery. His name was Gabry and for some reason he drowned himself in the Mississippi River so his period of service was a brief one. It was the pleasure of the writer to browse over a large wooden box filled with water-color drawings of huge Brazilian butterflies which Gabry had made while employed in Brazil. This box of drawings was stored with the plunder put away and forgotten in the plant of the Newcomb Pottery which was located on Camp Street.

For many years Mrs. Josephine Louise Newcomb paid the debts of the College at the end of each year and one enterprise, approved by her and paid for in this manner while she lived, was the Pottery.

IV. William Woodward Is Employed

It is good to look for another source of the beginning of this pottery. William Woodward came to Louisiana very soon after the end of the Civil War as instructor in drawing and painting in Tulane University. He had fostered a pottery enterprise known as the Baronne Street Pottery. A club of women had worked at making art pottery very much as was the case of the group working in the schoolhouse near Cincinnati when Rookwood was being born. George Ohr, sometimes known as "The Mad Potter of Biloxi" produced the ware on the wheel and glazed and fired the goods while the women decorated the ware with modeled handles and what not. Joseph F. Meyer was also employed in the Baronne Street enterprise.

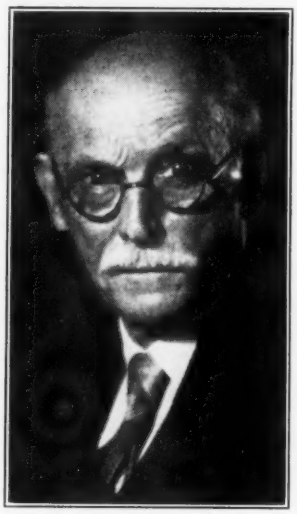
V. Newcomb College

Newcomb College had its first classes in an old residence which had been, during the Civil War, the headquarters for General Butler. After a rather short period in this old residence, which is across the street from the Howard

Reference Library, a move was made to Washington Avenue where an old residence formerly owned by an Englishman named Burnside was made over into a college plant. There were more than fifty fine live oaks in this block of ground, one of them being so large that its limbs covered the entire middle campus between the main building, the School of Art, and the Chapel. The live oaks, yucca plants in great Spanish jars, vines, palms, flowers and fruits, and the wealth of plant material in the forests and swamps not too far from this campus—all made the production of artistic ware certain if a leader would assume the burdens.

VI. Work of Ellsworth Woodward

Ellsworth Woodward, already with the College at its start, was endorsed by his brother William for the job at the new college for girls. Both of these men had been trained in the Rhode Island School of Design. Ellsworth Woodward later had added training in Munich, and William Woodward, in Paris. Both men worked as instructors in Newcomb College although William Woodward devoted the major portion of his time to the work at Tulane University.



ELLSWORTH WOODWARD.

Ellsworth Woodward realized that young women who had been born soon after the Civil War, who were victims of the ruthless plundering of the State by the "carpet-bag" government, and who had been bred to a life of sheltered ease could not be easily persuaded to undertake the fine arts unless some vocation should result from such training. These girls had to work and they knew it. Woodward had the New England idea of the need for hard work and felt that his opportunity would be found in a combination of thorough training in design and the application of the training to some product that could be sold. The pottery idea was one of the avenues he decided to open up.

VII. Newcomb Pottery Buildings

At first a small plant was built in the center of the block of ground close to the heating plant. The stack of the heating plant was used as a kiln stack. The first kiln was put up by a kiln builder from East Liverpool. It was a good kiln but there was never ware enough to fill it, so for a small enterprise it was a failure. A small muffle kiln was added.

After a few years in this small building in the center of the campus, a specially fine building, designed by Ellsworth Woodward in Spanish Colonial style, was built on a lot across the street from the main campus and here was enjoyed a golden period of success and growth.

VIII. Potters and Decorators

The first potter employed was Gabry. He was followed by George Wasmuth for a short time. To Joseph F. Meyer, the master potter, belongs the credit for the early success of this enterprise because there was not sufficient money for the employment of a less patient and very probably less capable man, and the very small wage would not have held any other potter of his great skill. He was the thrifty French peasant who always saved some of his wage even if he lived poorly to do it, and he loved the creative work so strongly that his pay came more from the pleasure in his work than in dollars.

Ellsworth Woodward, too, could have people work under him even when it did not pay because he made the surroundings so pleasant, the work so interesting, and the approval of the results so unselfishly warm. And he made it so apparent that the work was well worth doing. He allowed no one to get more work done each day than he did, but he never complained because others could not drive themselves as he did himself. People liked to work for him. The work, however, had to be good or he would do it over again himself. He never rebelled at the necessity of this extra work, even though he did it when he should have rested.

IX. Mary G. Sheerer on Staff

Ellsworth Woodward soon added Mary Given Sheerer to his staff. Miss Sheerer had been associated (though probably not to any great extent) with the women who helped to develop Rookwood. She was a china painter of great skill and more than any other thing she could secure real results in fine design from her students. She could and did select the shows that went out in competitions and she had to know her business to pick so many winners. She had excellent ideas of unusual technique and while opposite to Ellsworth Woodward in a number of ways they comprised the judging team for many years and chose so wisely that medals and grand prizes came to prove them right.

X. Status of Women Decorators at Newcomb

It is not possible to list all the names of the decorators who contributed to the long history of Newcomb Pottery. At first they were girls working as undergraduates, who usually took their ware home with them. These girls were never ceramists. They never attempted to make the glazes or the bodies, fire the kilns, or to do any of the things that ceramists pride themselves on doing. They were artists applying decorations to ware made and finished by other hands.

Of course, to a city like New Orleans would come the Northern visitor who would want to buy a piece of art ware made in this College by the daughters of the Confederacy, and so finally grew the idea of making a factory of the Pottery to make livings for some of the young women who liked to make pottery while they spent the years between college and marriage.

Ellsworth Woodward never conceded that any young woman could do as well for herself in any other way as in marriage with a family to interest her. He was first of all a teacher and second an artist and he preached from

the text that the fine arts are necessary for good living and that training in the fine arts well fitted a woman to be a mother. Some of his designers had ready-made families, however, because of the load fallen on their young shoulders. And so in its best period Newcomb Pottery had as its decorators a group of five women who worked from girlhood to middle age, making a living for themselves and their dependents through the production of a finely decorated pottery that pleased purchasers from the ends of the earth. No other American pottery has been so truly indigenous.

XI. Technique of Newcomb Pottery

From the standpoint of ceramic technique there is little of interest about Newcomb Pottery.[1] Up to 1910 a simple lead glaze applied over the underglaze painting was used. Following that time an ordinary mat glaze was applied over the same colors. Blue and green with a little red and a little yellow made the palette.

The work of the artists made the product.

XII. Later Artists

The writer went down in 1910, found a going concern, and was called upon to perfect the mat glaze and to modernize the plant. Market conditions justified the expansion and so the designers were able, on a piece-work basis, to raise their own pay from about $800 a year to as much as $3600 in one case. Frederick Walrath came down to replace the writer, on his resignation, and was employed there for two years (until his death). He was followed by Vincent Axford who was succeeded by Harry Rogers. The ceramist of Newcomb Pottery at present is Kenneth E. Smith.

After some twenty years, a new plant for the entire College was built about three miles away from the old one and the pottery work was consigned to basement quarters in the School of Art building. This move was made about the time the United States went into the World War and the advantage of a picturesque plant was lost to the Pottery enterprise.

XIII. Skill of Miss Irvine and Other Decorators

In the opinion of the writer, Miss Sadie Agnes Estelle Irvine was the greatest of the decorators in the history of the enterprise. A prolific but less inspired designer was Miss Fannie Simpson, who died a few years ago. Miss Henrietta Bailey never gave all of her time to pottery decoration but more of her ware went into prize-winning shows than her general average of work would predict. These three women have been the "standbys" of the Pottery. Dozens of others have come and gone and all of them had ware in the shows. Miss Maude Robinson of New York, who has a reputation by her own right, was an early designer at Newcomb Pottery. Mrs. I. Bentley Nicholson, a pottery producer with a reputation gained by work away from the College, is another. Some of the teachers still on the staff of the Newcomb School of Art gained skill by pottery decoration work as younger women.

[1] Reference is made here to an article by Mary G. Sheerer on "Newcomb Pottery," *Jour. Amer. Ceram. Soc.*, **1** [8], 518–28 (1918).

XIV. Medals and Prizes for Newcomb Pottery

Newcomb pottery has won medals at Jamestown, Paris, St. Louis, and numerous museum and art gallery shows. The Grand Prize was awarded to it at San Francisco. As a humble part of the organization, the writer has packed the ware shipped away to purchasers, and hardly a great home in Europe has not had at least one piece of Newcomb pottery shipped to it.

Newcomb Pottery has won forty-four blue ribbons at various state fairs where for many years the pottery was exhibited. It has not been the custom to award prizes for the last few years although the pottery has been on exhibit at most important expositions.

XV. Educational Values

The Newcomb Pottery project has been tried and has been found extremely successful in its endeavor. It has left a record of artistic and ceramic progress, over a period of some forty years, of which any educational institution might be proud.

The Pottery serves as a laboratory where art and science are blended and students may obtain practical information as to a method of earning a living by this thorough training in their chosen profession.

Miss Lota L. Troy is now director of the Newcomb School of Art. Miss Juanita Gonzalez teaches the classes in modeling and Kenneth E. Smith teaches ceramic chemistry and acts as sales manager in the Pottery.

DEPARTMENT OF CERAMIC ENGINEERING
IOWA STATE COLLEGE
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BUREAU OF STANDARDS KEEPS PRESTIGE DESPITE FUND CUT

Operating on a budget of less than one-half that provided for 1932, the Bureau of Standards is continuing its work in such fashion as to retain its prestige and authority, and during the past summer set a new record in the volume of materials tested for the government for use in new construction.

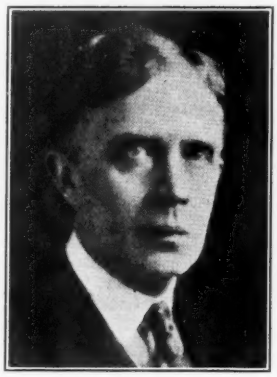
The appropriation for the Bureau of Standards for 1932 was $2,749,510. For the present fiscal year only $1,336,000 is available.

It was found necessary for the Bureau to maintain a primary and essential service of calibrating thermometers, graduated glassware, gages, weights, and electrical, optical, and mechanical measuring instruments in terms of national standards when called upon to do so by scientific and industrial laboratories.

Just as important was the necessity for answering the great number of daily inquiries for authentic technical information on every conceivable subject within the Bureau's field. Faced with these and other services that had to be maintained, the burden of retrenchment fell still more heavily upon other important Bureau activities.

The Branch Stations of the Bureau at Columbus, Ohio, and Tuscaloosa, Ala., were closed. The Master Scale Station near Chicago is being operated only one month during each quarter, instead of continuously. The work of the commercial standard groups, including Divisions of Building and Housing, Simplified Practice, Specifications, and Trade Standards, was reduced to a skeleton organization. Nevertheless, the greater part of the reduction had still to be met by a general curtailment of the scientific and technical research of the Bureau covering the development of new standards, the refinement of methods of measurement, and the determination of physical constants and the properties of materials.

DR. WILLARD PRESIDENT OF UNIVERSITY OF ILLINOIS



ARTHUR CUTTS WILLARD

ARTHUR CUTTS WILLARD has been honored with the presidency of the University of Illinois.

After completing a course in chemical engineering at Massachusetts Institute of Technology, Dr. Willard joined the Chemistry Department faculty of the California School of Mechanical Arts. A few years later he became a professor of Mechanical Engineering at George Washington University.

In 1913 he transferred to the University of Illinois. Since 1920 he has been Head of the Department of Mechanical Engineering and for the past year Acting Dean of the College of Engineering and Acting Director of the Engineering Experiment Station.

SILICOSIS TO BE COMPENSABLE UNDER ACT IN NEW YORK*

Insurance Companies, Employers, and Employees Agree on Terms of Bill

Silicosis, one of the deadliest and most insidious of industrial diseases, which, it is estimated, affects thousands of workers in the State to some degree and for which there is no known cure, would be brought under the terms of the Workmen's Compensation Law by an amendment introduced in the New York State Legislature. The bill was a Department of Labor measure, drafted after a series of conferences with insurance companies, employers, and labor, and represents an agreement in many respects.

C. R. AUSTIN JOINS BATTELLE STAFF

CHESTER R. AUSTIN

Chester R. Austin, who received his B.S. in 1928 and M.S. in 1929 in Ceramic Engineering at Ohio State University, has joined the technical staff of Battelle Memorial Institute, Columbus, Ohio.

From 1929–33 Austin was at the Roseville Experiment Station of Ohio State University. His work included a survey of Ohio shales and surface clays, developments in improvement in fuel practice for the ceramic industries, de-airing of clays, and testing of ceramic products, which makes him well qualified for the special refractory project to which he has been assigned at the Institute.

Austin is a member of the American Ceramic Society and Sigma Xi. Before coming to Battelle, he was employed as compressor engineer by the Ohio Fuel Gas Company, Cambridge, Ohio.

* From the *Potter's Herald*, April 12, 1934.

WILLI M. COHN RETURNS FROM JAPAN

Willi M. Cohn of Berkeley, California, returned from a trip to the South Seas and Japan early in April. While in Japan he met Seiji Kondo, professor in the Tokyo University of Engineering, and for many years a member of the American Ceramic Society and abstractor of Japanese technical periodicals for *Ceramic Abstracts*. Dr. Cohn lectured before the Japanese Ceramic Society on new means for obtaining extremely high temperatures, and Professor Kondo acted as interpreter for the address. Dr. Cohn writes that the Japanese seemed to be greatly interested in ceramic research and in the promotion of an understanding between two great nations bordering on the Pacific Ocean. A beautiful porcelain vase was presented to Dr. Cohn as a souvenir.

BELGIAN CERAMIC JOURNAL CHANGES NAME

The journal, *Verre et Silicates Industriels*, is being published in Brussels, Belgium. This publication was formerly known as *Revue belge des Industries Verrières Céramiques et de l'Emaillerie*, which has been abstracted in *Ceramic Abstracts* for many years.

The new publication is issued "bimonthly and is devoted to *all* of the industrial silicates; it now becomes the first French periodic in its gender."

Leon Francq is the editor of this publication.

The society called the "Études des Composés Siliceux," assumes the publications of (1) the *Review*, (2) the Yearbook (agenda), and (3) Monographs concerning all silicate industries.

The most cordial wishes are extended to this technical society by the American Ceramic Society.

WALTER SUTER AT NEW YORK CERAMIC STUDIOS*

Walter P. Suter has been added to the staff of the New York Ceramic Studios at 114 East 56th Street, New York, N. Y. Mr. Suter is conducting classes on Monday and Wednesday evenings.

Since coming to America, Mr. Suter has made a distinguished reputation as a sculptor and designer in the ceramic industry. In 1932 he was honored with the Syracuse Museum first prize for ceramic sculpture. Among his many well-known works are the large tile grills for the Bok Singing Tower in Florida, the terra cotta panels for the Detroit Institute of Art, and the decorative panels for the Delaware River Bridge in Philadelphia.

Mr. Suter has served as Chairman of the Art Division of the American Ceramic Society.

FERRO TRAINING COURSE POSTPONED

This course for porcelain enamelers, set for May 19, has been postponed until July, 1934, as this time was thought to be more convenient for those attending.

Harry E. Ebright of the Ferro Enamel Corporation who formerly handled Laboratory and Research work for the company will become an executive officer.

* For notice of the organization of the New York Studios see *The Bulletin*, **13** [1], 28 (1934).

ACTIVITIES OF A.S.T.M. COMMITTEE C-8 ON REFRACTORIES*

As a result of recent work of A.S.T.M. Committee C-8 on Refractories, new proposed specifications will be recommended for approval as A.S.T.M. tentative standards covering widely used refractory materials. Clay fire brick for use in incinerators is covered in one of the proposed standards, and ground fire clay in another. A great many fire brick are used in incinerating furnaces and because there have been formulated recently a number of conflicting specifications, much confusion has resulted with difficult production problems.

Action was taken at a recent meeting of Committee C-8 to propose the adoption as standard of the Tentative Method of Test for Particle Size of Ground Refractory Materials (C92–32T). This method, which is applicable also to such finished products as fireclay mortars and high-temperature cements, was first published in 1932 for criticism and review.

A number of revisions, which were previously submitted, in the Method of Test for Softening Point of Fireclay Brick (C24–33) will be proposed for adoption as standard.

The Tentative Method of Control Test for Resistance of Fireclay Brick to Thermal Spalling Action (C38–33T), often termed the "water-dip spalling test," is to be withdrawn. The committee is considering other methods to determine resistance of refractory materials to thermal and structural spalling. The withdrawal of the Definitions of Terms Relating to Heat Transmission of Refractories (C71–31T) will also be recommended. In place of these, the committee proposes the approval as tentative of the "Symbols for Heat Transmission" as approved by the American Standards Association.

A number of changes are to be proposed as tentative for inclusion in the Methods of Testing High-Temperature Heat Insulation (Compression, Flexure, Shrinkage) (C93–33T).

Several studies and research projects are being carried on by the committee. The investigation on methods for determining thermal conductivity of refractory materials is to be continued; a panel spalling test is being studied; and work is contemplated on load tests of heavy duty fire brick at temperatures higher than those now specified in the standard test.

The report of Committee C-8, to be presented at the A.S.T.M. annual meeting in Atlantic City, June 25 to 29, will review the year's work and give in detail all of the recommendations, proposed standards, etc., involving the refractories field. The officers of Committee C-8 on Refractories are *Chairman*, R. A. Heindl, Chief, Refractories Section, U. S. Bureau of Standards and *Secretary*, C. E. Bales, Vice-President, The Ironton Fire Brick Co.

CERAMIC WARE TO BE MADE AT THE 1934 CENTURY OF PROGRESS EXPOSITION

The story of the world's oldest industry will be told in one of the striking new exhibits at the World's Fair of 1934 in Chicago. The new building, covering 10,000 square feet, will house a demonstration of primitive and modern methods of making pottery. The exhibit, which will turn out 6000 finished pieces daily, is that of the Haeger Potteries, Inc., of Dundee, Ill.

Indian Pottery The San Ildefonso Indians of our desert Southwest are among the finest pottery makers among our North American primitives. A group of members of that tribe will be brought to the World's Fair to demonstrate their art. They will arrive early in May and will build adobe huts in the pottery exhibit just as they build them in San Ildefonso and other pueblo settlements.

Shipments of their own clays will be brought to Chicago. They will be shown screening the clay dust, mixing it with water, kneading it, and molding it by hand. They will build open fires and prepare their tiny kilns for firing.

The Indians use vegetable dyes for coloring their ware. These are made from native shrubs, herbs, and roots. They paint the colors on with primitive brushes. The Indians use no "wheels" for turning as the white man does. They shape all their vases and other ware with their hands; no two pieces are duplicates.

Modern Pottery by Haeger Adjoining this display of primitive pottery making will be a new and modern plant in operation. Here costly mechanical mixers will knead and mix the clays. The white man's colors, the gift of modern chemistry, will be ground and blended mechanically. The fine glazes will be prepared.

"Throwers" will spin clays into lovely shapes on their pottery wheels, artists will hand-decorate and also air-brush spray the dried shapes. The pottery will then be ready for the kiln.

A modern rotary kiln, 24 feet in diameter, is being built especially for the World's Fair of 1934. Here fine pieces will be carried automatically through the preheating stage, fired, and cooled. A complete cycle takes 24 hours. The kiln will operate 24 hours a day.

One part of the pottery exhibit will be a large hall where the newly manufactured pieces will be shown along with many fine show pieces gathered from various parts of the world. Many of these will be historical examples of the potter's art.

Porcelain Enamel The Porcelain Enamel Institute had a fine display at the Fair last year. It is returning with a bigger and better one in 1934. There will be added features and larger collections.

Glassware The Clover Leaf Crystal Shops, where fine glassware was shown last year, will have entirely new displays. Nothing but American glass will be shown. Glassmaking in the United States has received a great impetus in the last few months due to the demand for new glasses for serving wines and liquors. A complete line of these will be shown, the work of leading designers and makers.

The Owens-Illinois Glass Company, one of the world's largest glassmakers, will return with a large exhibit seeking to outdo its last year's exhibit. The "glass house" remains. This is made of "glass brick" and the company announces that it can now make these gleaming brick in 400 shades and colors.

THE SURVEY OF PERSIAN ART

Arthur Upham Pope is editing this volume which the Oxford University Press hopes will be ready next year. It is more than an outline of Persian art. It includes a comprehensive and systematic study of each phase by the outstanding authority.

The sections dealing with Persian pottery constitute the first adequate history of this important subject. There are 50 color plates in this section, 275 objects illustrated, innumerable new documents, technical and chemical information, the first thorough analysis of motives and styles, and the first specification according to provenance. The text of this section runs to over 50,000 words.

* Issued April 19, 1934.

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B

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McDanel Refractory Porcelain Co.

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Pacific Coast Borax Co.

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Pacific Coast Borax Co.
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C

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Paper Makers Importing Co.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Fire Brick
Carborundum Co.
Norton Co.

Flint
Paper Makers Importing Co.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Flint Pebbles
Ferro Enamel Corp.

Floors (Non-Slip)
Norton Co.

French Flint
Paper Makers Importing Co.

Frit
Ceramic Color & Chemical Mfg. Co.
Ferro Enamel Corp.
Porcelain Enamel & Mfg. Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Furnace
Carborundum Co. (*Carboradiant*)
Chicago Vitreous Enamel Product Co.
Ferro Enamel Corp.
Porcelain Enamel & Mfg. Co.

G

Glaze and Body Spar
Ceramic Color & Chemical Mfg. Co.
Paper Makers Importing Co.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Glazes and Enamels
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Drakenfeld & Co., B. F.
Ferro Enamel Corp.
Porcelain Enamel & Mfg. Co.
The Roessler & Hasslacher Chemical Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Glaze Spar
Ceramic Color & Chemical Mfg. Co.
Paper Makers Importing Co.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Gold
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Grinding Wheels
Norton Co. (*Alundum Crystolon*)

H

Hearths
Carborundum Co.
(*Carbofrax* heat treating)
Norton Co. (*Crystolon*)

Hearths (High Aluminous Clay, Electrically Sintered Aluminum Oxide, Silicon Carbide)
Carborundum Co.
Norton Co.

I

Iron (Enameling)
American Rolling Mill Co.

K

Kaolin
Ceramic Color & Chemical Mfg. Co.
Edgar Brothers Co.
Hammill & Gillespie, Inc.
Paper Makers Importing Co.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Kilns (China, Decorating)
Drakenfeld & Co., B. F.

Kryolith
Pennsylvania Salt Mfg. Co.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

L

Leeds (High Aluminous Clay, Electrically Sintered Aluminum Oxide, Silicon Carbide)
Carborundum Co.

Linings (Furnace Refractory, Block Refractory Plate, Brick and Tile)
Carborundum Co.
Norton Co.

M

Magnesia (Sintered, Calcined)
The Exolon Co.
Norton Co.

Magnesite
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
Hammill & Gillespie, Inc.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Manganese
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
Hammill & Gillespie, Inc.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Metals (Porcelain Enameling)
American Rolling Mill Co.

Minerals
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Muffles (Furnace)
Carborundum Co. (*Carbofrax*)
Ferro Enamel Corp.
Norton Co.

Mullite (Artificial)
The Exolon Co.

Muriatic Acid
Pennsylvania Salt Mfg. Co.

N

Nitrates (Cobalt, Sodium)
Ceramic Color & Chemical Mfg. Co.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

O

Opacifiers
Ceramic Color & Chemical Mfg. Co.
Metal & Thermit Corp.
The Roessler & Hasslacher Chemical Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Oxides
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
Ferro Enamel Corp.
Metal & Thermit Corp.
Pennsylvania Salt Mfg. Co.
The Roessler & Hasslacher Chemical Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

P

Pins
Potters Supply Co.

Porcelain Enameling Service (Practical)
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Ferro Enamel Corp.
Porcelain Enamel & Mfg. Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Porcelain Enamels
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Ferro Enamel Corp.
Porcelain Enamel & Mfg. Co.
The Vitro Mfg. Co.

Potash (Carbonate)
Ceramic Color & Chemical Mfg. Co.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Pyrometer Tubes (Refractory and Hard Porcelain)
McDanel Refractory Porcelain Co.

R

Refractories
Carborundum Co.
The Exolon Co.
Norton Co.

Refractory Materials
Carborundum Co.
The Exolon Co.
Norton Co.
Titanium Alloy Mfg. Co.

Rutile
Ceramic Color & Chemical Mfg. Co.
Metal & Thermit Corp.
The Roessler & Hasslacher Chemical Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

S

Saggers
Carborundum Co.
Norton Co.
Potters Supply Co.

Selenite of Sodium
Drakenfeld & Co., B. F.
The Vitro Mfg. Co.

Selenium
Drakenfeld & Co., B. F.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Sheets (Enameling Iron)
American Rolling Mill Co.

Silica (Fused)
The Exolon Co.

Silicate of Soda
Ceramic Color & Chemical Mfg. Co.
Philadelphia Quartz Co.
The Vitro Mfg. Co.

Silicon Carbide
The Exolon Co.
Norton Co.

Silicon Carbide Firesand
The Exolon Co.

Sillimanite (Synthetic)
The Exolon Co.

Slabs (Furnace)
Carborundum Co.
Norton Co.

Smelters
Chicago Vitreous Enamel Product Co.
Ferro Enamel Corp.
Porcelain Enamel & Mfg. Co.

Soda Ash
Ceramic Color & Chemical Mfg. Co.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Sodium Antimonate
Ceramic Color & Chemical Mfg. Co.
Metal & Thermit Corp.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Sodium Fluoride
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Spar
Ceramic Color & Chemical Mfg. Co.
Paper Makers Importing Co.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Spurs
Potters Supply Co.

Stilts
Potters Supply Co.

Sulphuric Acid
Drakenfeld & Co., B. F.
Pennsylvania Salt Mfg. Co.

BUYERS' GUIDE (continued)

T

Talc
Hammill & Gillespie, Inc.
Paper Makers Importing Co.
The Roessler & Hasslacher Chemical Co.

Tanks (Pickle)
Ferro Enamel Corp.

Tile (Refractory)
Carborundum Co. (*Carbofrax*)
Norton Co.

Tile (Wall)
Ferro Enamel Corp.

Tin Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
Metal & Thermit Corp.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Titanium
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Titanium Oxide
The Roessler & Hasslacher Chemical Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Tubes (Insulating)
McDanel Refractory Porcelain Co.
Norton Co.

Tubes (Pyrometer)
McDanel Refractory Porcelain Co.
Norton Co.

W

Wet Enamel
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Ferro Enamel Corp.
Porcelain Enamel & Mfg. Co.
The Vitro Mfg. Co.

Whiting
Drakenfeld & Co., B. F.
Hammill & Gillespie, Inc.
Paper Makers Importing Co.
The Roessler & Hasslacher Chemical Co.

Z

Zirconia
Ceramic Color & Chemical Mfg. Co.
Titanium Alloy Mfg. Co.
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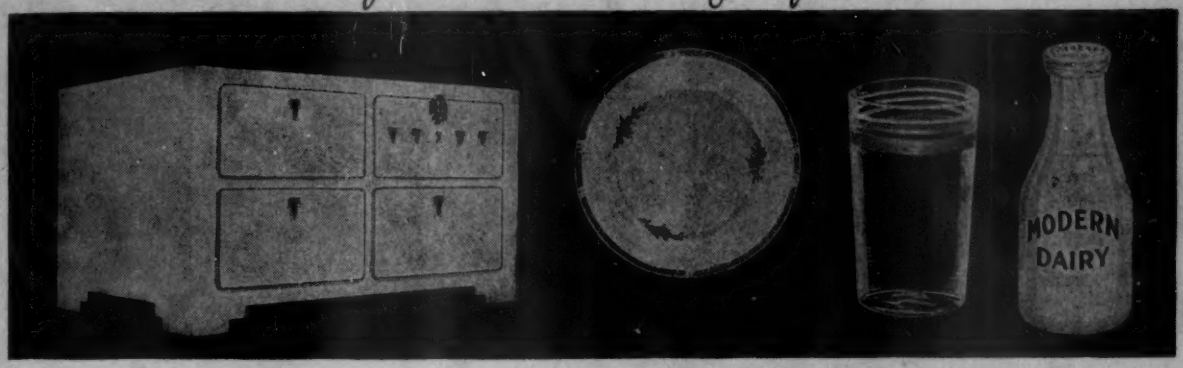

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